3. AFFECTED ENVIRONMENT

The Affected Environment section succinctly describes the existing environmental resources of the areas that would be affected if any of the alternatives were implemented. This section describes only those environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect or that would be affected by the alternatives if they were implemented. This section, in conjunction with the description of the "no-action" alternative forms the baseline conditions for determining the environmental impacts of the proposed action and reasonable alternatives.

3.1. GENERAL ENVIRONMENTAL SETTING

3.1.1. HISTORIC CONDITIONS:

Prior to the construction of the Central and Southern Florida (C&SF) Project, the elevation of the lakes within the Kissimmee Chain were determined principally by rainfall in the drainage basin. The ecological maintenance of the lakes depended on the climatic cycle of flood and drought. This cyclical rainfall pattern produced a wide range of water level fluctuations within the Kissimmee Chain. During extended periods of either condition, extreme lake level changes occurred. Aquatic plant and animal populations evolved and were controlled by this cyclical pattern. Accordingly, extreme water fluctuations played an important role in sustaining extensive areas of high-quality aquatic habitat.

FLOOD/DROUGHT CYCLE: Historically the Kissimmee Chain of Lakes fluctuated between two and ten feet seasonally, providing natural cleansing and drying out which sustained the natural flora and fauna (Sorensen & Turner, 2001). During floods, tussocks (floating plant islands) and nutrient rich sediment were carried over normally dry floodplains, allowing aquatic organisms to use the flooded terrestrial resources. When floodwaters receded, tussocks and sediment were deposited on dry land. Nutrients from decaying plants and sediment became fertilizer for upland vegetation. During extended drought the reverse cycle occurred, exposing large lake bottom areas to the intense Florida sun. During these natural drawdowns, tussocks and rooted aquatic plants, along with dead and decaying matter (muck), would consolidate, dry and oxidize. Terrestrial organisms readily utilized these lake bottom resources. This natural cycle of flood and drought maintained the lakes' long-term ecological balance primarily through removal of excess organic material. This resulted in lake water quality improvements favorable to plant and animal communities best suited to these extreme conditions. Hardy plant and animal species, which survived, reproduced and spawned the next generation of lake life. Populations of these organisms thrived and increased under optimum water quality conditions. The natural water level fluctuations supported the fishery and wildlife habitat, but made residential and agricultural developments difficult if not impossible due to flooding (Sorenson & Turner, 2001).

3.1.1.1. Lake Toho

For the period of record from January 1942 to 1964, the lake fluctuated between 59.4 MSL and 48.93 MSL, a range of 10.47 vertical feet (United States Geological Survey, unpublished). Construction of the lock and spillway (S-61) was completed in January 1964 and the interim regulation schedule implemented in 1964. From 1964 to 1970, the elevation of Lake Toho was controlled between 56.09 MSL to 51.35 MSL, a difference of 4.74 vertical feet. (Wegener and Williams, 1974).

3.1.1.2. Lake Cypress

Prior to regulation, Lake Cypress had an historical high water up to 56.8 MSL (Williams, 1980).

3.1.1.3. Lake Hatchineha

Prior to regulation, Lake Hatchineha had historic fluctuation up to 55.0 MSL (Williams, 1980) with the minimum being 47.29 MSL.

3.1.1.4. Lake Kissimmee

Prior to regulation, Lake Kissimmee fluctuated from 44.2 MSL to 56.6 MSL for a range of 12.4 vertical feet. Lake Kissimmee would fluctuate usually 6.5 to 7 feet in vertical height.

3.1.2. EXISTING CONDITIONS

In the early 1960's, during construction of the C&SF Project, major channelization occurred in the Kissimmee Basin, and water control structures were placed at many of the lake outlets (Williams, 1980 and 1984). Since the completion of the flood control project, water levels have been artificially restricted within a very narrow range of fluctuation; historic high and low stages are no longer achieved (see parts 1, 2, and 3 of Appendix B and the graphs referred to therein). Major contributors to a deteriorating desirable aquatic habitat in the Kissimmee Chain of Lakesare water level stabilization, pollution from watershed development, and rapid population growth (Wegener & Williams, 1974). Dense bands of organic material have formed along the lakeshore due to restricted water level fluctuation schedules (Wegener & Williams, 1977). This orgainic material, combined with aquatic plants such as pickerelweed, cattail, and smartweed, formed barriers impassable by fish that limits their access to shallow spawning areas (Moyer, 1991). Biological productivity of some fish species decreases as organic sediment depths increase. Declines in coverage of desirable aquatic vegetation negatively impact the diversity and abundance of forage organisms that depend on these plant communities. In turn, this directly contributes to reduced sport fish production and wading bird utilization.

3.1.2.1. Lake Toho

The current revised regulation schedule has a 3.0 vertical fluctuation between 55.0 MSL (high pool) and 52.0 MSL (low pool) with a 1 in 3 year drop to 51.5 MSL. Lake Toho is connected to East Lake Toho by C-31 and East Lake is regulated by the S-59 control structure. Fish Lake connects to Lake Toho by the Partin Canal, which drains into the north lobe of the lake. Other tributaries to Lake Toho include west city ditch, Shingle Creek, Mill Slough, and a ditch in the northeast corner of the lake. Lake Toho is regulated by S-61 and is connected to Lake Cypress by C-35.

3.1.2.2. Lake Cypress

Under the current regulation schedule, Lake Cypress fluctuates between 49.0 MSL and 52.5 MSL, a difference of 3.5 vertical feet, with a drop to 48.5 MSL in 1 out of 3 years. This lake is connected to Lake Toho by C-35 and Lake Hatchineha by C-36. Lakes Cypress, Hatchineha and Kissimmee are regulated by a single structure, S-65, at the base of Lake Kissimmee. No specific drawdowns have been previously implemented for Lake Cypress.

3.1.2.3. Lake Hatchineha

Under the current regulation schedule, Lake Hatchineha fluctuates between 49.0 MSL and 52.5 MSL, a difference of 3.5 vertical feet, with a drop to 48.5 MSL in 1 out of 3 years. Lake Hatchineha is connected to Lake Cypress by C-36 and to Lake Kissimmee by C-37. Lakes Cypress, Hatchineha and Kissimmee are regulated by a single structure, S-65, at the base of Lake Kissimmee. Prior to channelization, the meandering river now called C-37 caused Lake Hatchineha to have higher water levels than presently. Lake Hatchineha has a maximum depth of 12 feet with an average depth of about 7 feet. Major tributary waters include Lake Marry canal, Reedy Creek, Dead River, and C-36. No specific drawdowns or habitat enhancement projects have been previously implemented for Lake Hatchineha.

3.1.2.4. Lake Kissimmee

Under the current regulation schedule, Lake Kissimmee fluctuates between 49.0 MSL and 52.5 MSL, a difference of 3.5 feet, with a drop to 48.5 MSL in 1 out of 3 years (Williams, 1980). Maximum water depth is 20 feet with the average depth being less than 10 feet. Lake Kissimmee is connected to Lake Hatchineha by C-37. Lakes Cypress, Hatchineha and Kissimmee are regulated by a single structure, S-65, at the base of Lake Kissimmee. Major tributaries are Lake Jackson canal, Tiger Creek, Zipper canal and C-37.

3.2. VEGETATION

A balanced aquatic plant community is essential to the ecological well-being of all lakes. Aquatic plants benefit lakes by harboring food organisms for fish and waterfowl, providing spawning areas and protective cover for fish, preventing shoreline erosion and stabilizing the lake bottom, producing oxygen and organic material for other life in the lake, and providing food and building materials for a variety of wildlife species.

In many lakes that have been disturbed by human activity, aquatic plants can grow to excess. This can seriously impair a lake's recreational use by limiting boating, swimming, and fishing. Nuisance weeds are one of the most common problems faced by lake users and managers.

A nuisance plant is defined here as a species, that under certain environmental conditions, will expand and form single species clumps, or monocultures, similar to non-native species. Non-native plants, defined here as species originating from other parts of the world, also impact natural systems by displacing native plant species which in turn impacts the feeding, nesting, and movement of animal species. Also, some non-native plants freed from diseases and predators found in their places of origin will rapidly expand without human intervention. Both of these types of plants do well in disturbed site or nutrient enriched conditions and will tend to crowd out other native plant species if they are not managed. Usually, these species spread by rhizomes (underground roots) or runners, seeds, or fragments. Species that benefit from stabilized water levels include the following: torpedograss (*Panicum repens*), and nuisance native species: pickerelweed (*Pontederia cordata*), smartweed (*Polygonum spp.*), cattails (*Typha spp.*), willow (*Salix spp.*), and burhead bulrush (*Scirpus cubensis*). Other natives such as spatterdock (*Nuphar luteum*) and American lotus (*Nelumbo lutea*) also expand with stabilized water levels to the point of limiting access. These plants have extensive root systems, which hold together muck and accelerate the muck building process.

3.2.1. LAKE TOHO CURRENT VEGETATION

A baseline for the vegetative community prior to regulation was provided by Hurkley (1957) and Wegener (1969). The study by Hurkley, indicated that the high water level was demarcated by oak and cypress then lower elevations by herbaceous species, which was limited to southern bulrush (*Scirpus californicus*) with some pickerelweed. A submersed algae, *Nitella spp.* was dominant with very sparse eelgrass (*Vallisneria americana*) and Illinois pondweed (*Potamogeton illinoensis*) clumps. The study by Wegener (1969) noted that the most abundant plants were rooted emergent species such as grasses (*Panicum spp.*) and giant bulrush (*Scirpus californicus*), which were found all around the lake. The remaining aquatic species present in lesser numbers were cattails, pickerelweed, waterlilies (*Nymphaea spp.*) and spikerush (*Eleocharis spp.*). The one problem species was water hyacinth (*Eichhornia crassipes*), which expanded in many areas to form patches as large as 100 acres all throughout the lake. In the early 1970's, the plant community shifted to a grass based complex of maidencane (*Panicum hemitomon*), knotgrass (*Paspalidium geminatum*), and torpedograss with only scattered cattails, pickerelweed, and spikerushes.

Since 1983, the acreage of non-native and native plants has been collected by the Department of Environmental Protection, Bureau of Invasive Plant Management (Tables 3a-d) where the entire waterbody is surveyed and the acreage for all (native and non-native) species is calculated. Between 1983 to 1995, a full survey was done every other year. In 1995, the survey interval was increased to five years and a full survey was not conducted in 2000 or 2001 due to drought conditions. In the partial survey years, only the acreage of non-native species is calculated. The species were put together into 9 groups or complexes by growth form to assist with determining any trends in the data. Group 1 was comprised of native grasses, rushes , and sedges , group 2 was comprised of native submersed species such as coontail (*Ceratophyllum demersum*) and bladderworts (*Utricularia spp.*), group 3 was comprised of native emergent species such as arrowhead (*Sagittaria spp.*) and bulrush (*Scirpus spp.*), group 4 was comprised of non-native emergent species such as alligatorweed (*Alternanthera philoxeroides*), group 5 was comprised of lily species such as spatterdock, group 6 was comprised of native floating species such as duckweed (*Lemna spp.*) and frog's bit (*Limnobium spongia*), group 7 was comprised of non-native floating species such as water hyacinth and waterlettuce (*Pistia stratiotes*), group 8 was comprised of non-native submersed species such as hydrilla, and group 9 was non-native grasses such as torpedograss. The acreage of several individual species such as smartweed, cattail, pickerelweed, spatterdock and smartweed to look for any trends.

The DEP survey data for Lake Toho (charts 3a-3d) indicates the following continuing trends: an increase of native and non-native submersed species, increases in non-native grasses, and increases in lily species. For individual species, increases were also noted: cattail, pickerelweed, spatterdock, and smartweed. Native grasses after the 1987 drawdown came back at higher acreage than pre-drawdown levels with some decline in 1995. There was a dramatic increase in non-native grasses, due mainly to paragrass (*Urochloa mutica*), after the 1987 drawdown and 1993, a high water year.

The littoral zone on this lake consists of a mix of herbaceous and woody species with a width from 50 feet to 450 feet. The dominant species are: pickerelweed, smartweed, cattails, willow, primrose willow (*Ludwigia octovalvis/peruviana*) torpedo grass, and burhead bulrush. The northern end of the lake has problems with tussock formation from the above species. Rising water and wind events cause the creation of tussocks (floating islands), which break loose from the soft substrate and then - float freely throughout the lake. Tussocks can range from the proportions of a recreational boat to ½ acre in size and in the past have blocked drainage canals, boat ramps and clogged the S-61 structure. Also, tussocks settle over desirable vegetation and remove it by shading and scouring with wind action. The dominant plants in deeper water are hydrilla (*Hydrilla verticillata*) and spatterdock.

3.2.2. LAKE CYPRESS CURRENT VEGETATION

In the 1960's, the dominant vegetation on Lake Cypress were southern bulrush and grasses with limited pickerelweed, cattails, coontail and eelgrass (*Vallisneria Americana*). The DEP survey data indicates that the levels of most plant complexes appeared stable with a few exceptions. After the 1988 drawdown, there was a spike in non-native emersed; due to alligatorweed, then went back down. There was a small increase in non-native grasses mainly due to torpedograss. In 1992, there was a significant increase in hydrilla.

The littoral zone on Lake Cypress consists of herbaceous species. The eastern and southern shore has cattle grazing which has impacted the type of species. The dominant plants are smartweed, pickerelweed, alligatorweed, pennywort (*Hydrocotyle spp.*), and beggar ticks (*Bidens* spp.) The shallow water plants consist of cattail, knotgrass, maidencane, and bulrush. In 2001, due to the drought conditions much of the vegetation on the northeast shoreline was extensively grazed including the bulrush and knotgrass (per. com. Catherine Johnson, 2002). The western shoreline has an extensive marsh area in which the dominant species are cattail, pickerelweed, pennywort, smartweed and occasionally willow.

3.2.3. LAKE HATCHINEHA CURRENT VEGETATION

According to Wegener, Williams and Buntz (1973) the lakeward limit of rooted emergent vegetation corresponds to the historical low water elevations. On Lake Hatchineha, the littoral zone was limited to a narrow band, approximately 100 yards wide around the lake perimeter. The dominant emergent vegetation consisted of grasses, scattered patches of bulrush, and pickerelweed with sparse submerged vegetation probably *Nitella spp.*, coontail and eelgrass.

Native floating plant species took off with high water levels in 1992/93 then declined. There was an increase in non-native emersed species, due to alligatorweed after the 1987 drawdown. In 1988, there was a slight increase in acreage for native submersed due the drawdown. There were similar increases noted in 1988 for the native and non-native grasses. The main species for increases in native grass acreage were due to *Eleocharis spp.*, southern watergrass and *Cyperus spp.* The main reason for increases in non-native grasses was to expansion of torpedograss.

The littoral zone on this lake consists of a mix of herbaceous and woody species. The northern marsh area is approximately ½ mile from the lake edge to the tree line at the widest point to 150 yards at the narrowest. The dominant species now present from the waters edge to the tree line is a mixture of the following: pickerelweed, smartweed, cattails, lanceleaf arrowhead (*Sagitteria lancifolia*), willow, primrose willow, buttonbush (*Cephalanthus occidentailis*), and St. Johns wort (*Hypericum* spp.). From the shoreline into shallows (<1 foot) the species are cattails, smartweed, bulrush, pickerelweed, pennywort, knotgrass, and maidencane. In depths greater than 1 foot, hydrilla, *Nitella spp.* and spatterdock are the dominant plants. On the southern shoreline, the distance to the treeline is about 100 yards. The dominant plant in this area is a cattail monoculture.

3.2.4. LAKE KISSIMMEE CURRENT VEGETATION

A baseline for the vegetative community prior to regulation was provided by several sources. A 1957 study by Hurkley indicated that the high water level was demarcated by oak and cypress then lower elevations by herbaceous species. On Lake Kissimmee, the main tree/shrub species were cypress, willow and buttonbush. Of the emergent vegetation present, southern bulrush was the dominant species with some pickerelweed. *Nitella spp.* was the dominant submersed species with very limited eelgrass and Illinois pondweed clumps. The dominant species were bulrush and Kissimmee grass (local name for a complex of three grasses - maidencane, knotgrass, and torpedograss with limited pickerelweed, cattails and lilies. According to Wegener et al. (1973), the historical low water elevation was the lakeward limit of aquatic emergent vegetation and that Lake Kissimmee had a wide littoral zone. The dominant emergent species were grasses, bulrush, yellow water lily (*Nuphar spp.*), pickerelweed and pennywort. Vast areas of submerged aquatic plants were present with the dominant species being spikerush, eelgrass, and St. Johns wort.

Trends noted in the DEP survey data were that Lake Kissimmee had the highest acreage for lily species, which also increased after the 1988 drawdown. There was also a spike for non-native floating plants in 1988, which was due to seed germination. This was also seen after the previous Lake Toho drawdown. The 1988 drawdown also caused a positive response in the native submersed and emersed plant species. For the submersed species, the main increases were in bladderwort species. The largest increases in species acreage were for knotgrass, maidencane, and watergrass (*Luziola fluitans*).

3.2.5. CURRENT AQUATIC PLANT MANAGEMENT PLANS

Florida's natural systems are being invaded by many non-native plants, which have been introduced as food sources for man and animal, horticulture, the aquarium trade, and agriculture. Species that are successful invaders have several traits in common: the ability to grow rapidly, reproduce by fragmentation as well as seed, disperse easily and tolerate a wide variety of environmental conditions. Aquatic non-native plants impact the ability to move water through the lakes and structures, jeopardize the structural integrity of bridges and water control structures, limit navigation and shut down water related business and decrease habitat for native fisheries and wildlife. Terrestrial non-native plants, specifically in natural areas, displace native plant species or hybridize with related native species, disrupt animal feeding and reproduction, and alter fire regimes. The major components of the invasive plant management program in the Kissimmee Chain are prevention, monitoring, management, and restoration or enhancement.

3.2.5.1. Prevention

In addition to the federal list, there are two state lists that limit cultivation and use of invasive plants. The Florida Noxious Weed List, maintained by the Department of Agriculture and Consumer Services, focuses mainly on agricultural pest plants, has some but not all of the invasive plants in natural areas. The Prohibited Aquatic Plant Management List, which is maintained by the Department of Environmental Protection, Bureau of Invasive Plant Management (DEP, BIPM) is the basis for enforcement action when prohibited plants are found in the landscape or for sale. In the Kissimmee Chain, prevention focuses mainly on public education of boaters and homeowners through signs placed at boat ramps reminding boaters to remove invasive plant material from their trailers, to information placed on message boards at local ramps, and education by all agency personnel on a one-on-one basis or through programs to homeowner groups or native plant societies and garden clubs.

3.2.5.2. Detection

Target plants in the aquatic arena are floating, water hyacinth and waterlettuce, and submersed, mainly hydrilla. However, limnophila (*Limnophila sessiliflora*) and hygrophila (*Hygrophila polysperma*) are slowly spreading throughout the Kissimmee Chain and currently there are no means for control of these species. The terrestrial program is mainly on SFWMD lands and focuses on the removal of Chinese tallow (*Sapium sebiferum*), tropical soda apple (*Solanum viarum*), melaleuca (*Melaleuca quinquenvia*) and Brazilian pepper (*Schinus terebinthifolius*). SFWMD personnel inventory levels of invasive plants on district lands. Surveys to monitor levels of aquatic plants are made on a monthly basis by DEP, SFWMD, or Corps personnel and help direct management efforts.

Since 1983, the acreage of non-native and native plants has been collected by the Department of Environmental Protection, Bureau of Invasive Plant Management (BIPM) on the Kissimmee Chain by lake (Tables 3a-d). In this survey, the entire lake is surveyed and the acreage for each species is calculated. Between 1983 to 1995, a full survey (all native and non-native species) was done every other year. In 1995, the survey interval was increased to five years and a full survey was not conducted in 2000 or 2001 due to drought conditions. In the partial survey years, only the acreage of non-native species is calculated.

3.2.5.3. Management

Efforts including using multiple approaches, which are control burns, mechanical removal, herbicide programs, water manipulation, and biological control agents. Funding for management efforts comes from federal, state, and local agencies with the lead agency being DEP, BIPM through the Aquatic Plant Control Program and the Upland Invasive Plant Program. An annual workplan for each lake or parcel detailing the proposed management plan and methods are submitted for funding through a workplan review process in which all agencies participate. Vegetation management on the Kissimmee Chain is a team effort; an interagency working group makes decisions with federal, state, local agency representatives as well as members of the general public. The priorities for management are: 1) flood control; 2) maintain navigation through the Kissimmee Chain to the Kissimmee River and Lake Okeechobee; 3) fishery enhancement and wildlife protection; 4) aesthetic improvements (Feller, Bodle, Harris, 1998). Management efforts have focused on keeping water hyacinth and waterlettuce at the lowest possible levels, which is done by chemical treatments on an ongoing basis by SFWMD personnel. Other plant work such as the control of pickerelweed, spatterdock, and smartweed in scraped areas is conducted by FWC and DEP on an as needed basis. No aquatic plant operations are conducted in the area of snail kite nesting until the chicks have fledged. These sites are marked and the location shared by the SFWMD crews and FWC personnel.

Hydrilla, which first was identified in the Kissimmee Chain in 1972, did not become the dominant submersed plant until the early 1980's in several lakes. The hydrilla treatments are the largest component of the aquatic plant management program. Hydrilla is a rooted plant that branches extensively 1-2 feet below the water surface, which creates a thick mat that impedes boat access and water movement and is controlled by chemical and mechanical means. Harvesters have been used to cut trails for boat access on Lake Cypress to Lake Toho and Hatchineha, and to remove tussocks on Lake Toho and Kissimmee.

Since the 1980's, large-scale herbicide treatments have been conducted on the major lakes in the chain. A large-scale treatment is defined as a treatment that cost more than $50,000. These treatments over time have reduced the large hydrilla stands to topped out pockets or a band along the shoreline. Until July 2001, funding has been inconsistent and limited, with some lakes receiving a large-scale treatments every other year, this allowing hydrilla to expand throughout the lake between treatments. The large scale hydrilla treatments have been conducted in the Feb – March timeframe since 1996 due to less rain, water movement, less impact on native species. Hydrilla starts growing in these months before native plant species. Depending on the water level, a temporary schedule deviation may be requested in order to limit water release until June, giving the herbicide longer exposure to the hydrilla. Results of the winter treatment depending on many variables may be seen as early as May/June. Touch-up treatments occur in September/October if additional funding is available.

3.2.5.4. Restoration/Enhancement

The FWC has been the lead agency in this area with replanting native vegetation in areas after removal of non-native species. Due to the stabilized water levels in the Kissimmee Chain, several native species have become problematic. These species expand and cover the littoral zone in single species stands very similar to non-native plants. The FWC has also funded, in conjunction with DEP, the thinning and management of cattails, smartweed and pickerelweed stands on scraped areas to create a more diverse native plant community. Cattail and spatterdock are treated year round while pickerelweed responds best to fall treatments. Every scraped site is put on a regular maintenance schedule, usually yearly, but the area would be treated more often if needed.

3.3. THREATENED AND ENDANGERED SPECIES

According to information received in letter dated May 7, 2001 from USFWS, (see Appendix G), the following federally listed threatened and endangered species can be found in the project area.

These lakes supports a higher than average density of federally threatened bald eagles. Nest surveys, which are conducted by FWC biologists, indicate that many of these nests are currently active. The nesting season is generally from October 1 to May 15, but can occur as late as August. Eagles are most vulnerable to disturbance early in the nesting period, i.e. during courtship, nest building, egg laying, incubation, and brooding (roughly the first 12 weeks of the nesting cycle). Disturbance during this critical period may lead to nest abandonment and/or chilled or overheated eggs or young. Human activity near a nest later in the nesting cycle may cause premature fledging, thereby lessening the chance of survival. A map indicating locations of bald eagles nests has been provided by Florida Fish & Wildlife Conservation Commission and is located in Appendix G (G-14).

Breeding areas for the federally threatened Audubon's crested caracara (*Caracara plancus audubonii*) have been identified on the southern portion of Lake Toho. Buffer areas for these nesting territories are established for these nesting locations to encompass the southern shore of the lake.

The federally endangered Everglades snail kite (*Rostrhamus sociabilis plumbeus*) has established nesting areas in Lake Toho and East Lake Toho. Recent surveys indicate six active nests in the Lake Toho area.

The federally endangered wood stork (*Mycteria americana*) has also been documented in the Lake Toho area by FWC biologists; however, no nesting activity has been confirmed.

3.4. FISH AND WILDLIFE RESOURCES

Desirable aquatic plants, which formerly grew in the broad littoral zones, provided habitat for diverse and abundant planktonic, insect, amphibian and forage fish species. This food base sustained several species of sport fish, waterfowl, and wildlife. Numerous species in these animal groups decline or relocate as nuisance vegetation becomes overly dense, eliminating forage habitat and feeding opportunities. Under the existing lake conditions, sport fishing, hunting, bird watching, and other outdoor recreational activities are stifled as the aquatic habitat resource base declines.

Black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropeterus salmoides*), bluegill (*Lepomis macrochirus*), and redear sunfish (*Lepomis microlophus*) are the primary sportfish species in the Kissimmee Chain of Lakes. All of these sportfish species forage on zooplankton and insects as their primary food early on in their life histories. As they grow to adult sizes, largemouth bass become heavily piscivorous. Black crappie become piscivorous as well, but can maintain insects and zooplankton as a large part of their diet depending on availability. Bluegill continue to forage on zooplankton, but prefer primarily insects. Redear sunfish tend to switch to an insect and snail diet. Fish tend to be opportunistic and often feed upon readily available forage, therefore, their diets have a high degree of plasticity. The exception is largemouth bass, as they are more dependent on fish as food. Largemouth bass will eat insects, amphibians, etc., but often require fish as prey in order to grow fast and survive (personal communication, Martin Mann, November 2001).

Littoral zones also provide habitat for many birds to include the American coot (*Fulica americana*), ring-necked duck (*Aythya collaris*), Northern pintail (*Anas acuta*), blue-winged teal (*Anas discors*), mottled duck (*Anas fulvigula*), great and snowy egrets (*Casmerodius albus, Egretta thula*), great blue heron (*Ardea herodias*), tri-colored heron (*Egretta tricolor*), little blue heron (*Egretta caerulea*), and limpkin (*Aramus guarauna*).

3.5. GROUND WATER

The groundwater system in the three counties (Osceola, Orange and Polk) within the study area consists of a thin surficial aquifer and a thick high-permeability rock aquifer separated by a thin confining unit. The confining unit, commonly known as the Hawthorne formation, tends to restrict the exchange of water from the surficial aquifer to the below rock (Floridan) aquifer. However, past studies indicate that the surficial aquifer tends to recharge the Floridan aquifer on the order of 1-2 inches/year on average over the project area.

The lakes within the project area are relatively shallow and reside within the surficial aquifer. The surficial aquifer varies in thickness from 20 feet to 300 feet and is comprised predominantly of sandy and silty sediments with horizontal hydraulic conductivities (a measure of how easily water moves in a certain direction through the aquifer) varying between 1-100 feet/day. However, aquifer and pumping tests at several wells near Lake Toho indicate average horizontal conductivities on the order of 10 feet/day with vertical conductivities much lower. Higher hydraulic conductivities will tend to increase the area of influence that a drawdown in surface water will exert on the surrounding groundwater levels.

Also, hydraulic gradients (or the difference in groundwater levels from location to location) are generally small throughout the project area, but around the lakes they are much steeper. These rather steep gradients suggest that changes in lake surface water levels would only affect a narrow zone of groundwater around the lakes. If nearby groundwater levels were observed to be almost identical to lake levels (particularly as the distance from the lake increased), it would suggest that the aquifer was highly permeable and that declines or increases in lake levels would similarly affect adjacent groundwater levels. However, as this is not the case according to well observations within the project area, it suggests that the surficial aquifer is not highly permeable and that the extent of lake effects on groundwater resources would be rather limited.

Although hydraulic conductivity is the primary factor in determining the extent of influence that lake levels will exert on adjacent groundwater levels, there are other hydro-meteorological and drainage factors to consider. Since rainfall is the primary recharge and evapotranspiration the primary release from the surficial aquifer, it is during times of reduced rainfall and increased evapotranspiration that the effects of a lake draw down on groundwater levels will be most severe. Drought and particularly extended drought would tend to produce these exacerbating conditions. Also, the effects of the lake on groundwater are understandably reduced as the distance from the lake increases. Lastly, discharge from the surficial aquifer can occur as seepage into drainage features (i.e., creeks, sloughs, ditches). If these drainage features are hydraulically connected to the lake and possess sufficiently low invert elevations, drawn down lake levels may promote the overdrainage of groundwater resources towards the lake.

The above characterizations are general and qualitative in nature. In order to estimate quantitatively the effects of the drawdown on adjacent groundwater resources, a hydrologic model simulating groundwater/surface water interaction was developed for the project area. Although simulations were run for a number of varying hydro-meteorological conditions, the most severe condition (normal/drought/drought) was plotted (see Volume II, Figure 5-3) showing the areal and magnitude extent of the groundwater impacts. The figure reveals that the areal extent of impacts to groundwater resources resulting from the Lake Toho drawdown project is limited to within 1.3 miles of Lake Toho and does not extend to any of the commercial fish farms. Maximum stage impacts are predicted to be 1 foot for the Toho 1 well (0.3 miles from lake) and 0.3 feet for the Toho 2 well (1 mile from lake).

In order to gain a better understanding of the hydrologic system and the interaction between surface water and groundwater in the project area, one should consult Volume II, sections 2.1 and 2.2. Geology and hydrogeology of the project area, including hydraulic properties of the surficial aquifer, are presented in Volume II, section 3.11.1.

3.6. DOWNSTREAM (KISSIMMEE RIVER)

The outlet of Lake Kissimmee is structure S-65 (refer to location map) that controls flow to the Kissimmee River downstream of Lake Kissimmee. Criteria for Kissimmee River Restoration have been developed for continuous flow, flow velocities, stage-discharge relationships, stage recession rates, and stage hydrographs. Specific hydrologic restoration criteria (presented in Section 8.4.4 of the Kissimmee River Restoration Study, USACE, 1991) are based on requirements of wading birds, game and forage fish, invertebrates, and other organisms. Biological monitoring results support restoration success of this project.

3.7. WATER QUALITY

Water quality in Lake Toho improved markedly from 1982 to 1992 as a result of reductions in phosphorus and nitrogen loading to the lake (James et al., 1994). Annual budgets of water, chloride, phosphorus, and nitrogen were constructed for the lake, and indicate it is a sink for phosphorus and a source for nitrogen. These improvements in water quality are attributed to the diversion of wastewater treatment plant effluent from the lake, and the increased use of wet retention ponds for stormwater runoff.

3.8. HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

Preliminary research (background information, literature search, etc.) revealed that no known sources of HTRW materials exist in the directly impacted portions of the project area. The following signs of potential HTRW problems were not identified: landfills, dumps and disposal areas; burning or burned areas, underground basins, pits, quarries and borrow areas, wells; containers, odors, stressed or dead vegetation; buildings; and transport areas, such as boat yards, harbors, airports and truck terminals. No sites with potential for contamination with HTRW were found. The existing Publicly Operated Treatment Works (POTW) wastewater treatment plant near Lake Toho should cause minimal contamination if any in the lake. Additional trip reports, photos, and other documentation are on file in Jacksonville District Office.

3.9. AESTHETIC RESOURCES

Consideration of aesthetic resources within the project study area is required by the National Environmental Policy Act of 1969 (NEPA) PL 91-190, as amended. Aesthetic resources are defined as "those natural and cultural features of the environment that elicit a pleasurable response" in the observer, most notably from the predominant visual sense. Consequently, aesthetic resources are commonly referred to as visual resources, features that can potentially be seen. The lands adjacent to the project are of low relief and provide many panoramic view corridors of open lake waters and adjacent prairie and swamp in the rural setting. Many of the Kissimmee Chain lakes are rimmed by sandy shorelines, pine flatlands and or mesic oak hammocks in the immediate background. Overall the project area possesses moderately good aesthetic characteristics and value, with floating vegetation and emergent vegetation in areas the exception.

3.10. PREVIOUS LAKE DRAWDOWNS

The FWC implemented drawdowns of East Lake Toho in 1990, Lake Toho in 1971, 1979 and 1987; Lake Kissimmee in 1977 and 1996; Alligator Chain in 2000, and Lake Jackson in 1994, 1995, and 1997.

These drawdowns were done to eliminate unwanted aquatic vegetation, facilitate muck removal and to improve overall aquatic habitat. The drawdowns had the desired effects: Bottom sediments did oxidize and consolidate, new vegetation communities were established, and fish food organisms significantly increased with a subsequent increase in sport fish populations (Holcomb and Wegener, 1971; Wegener and Willams, 1974; and Wegener et al., 1974). According to Cooke and Kennedy (1989), "Water level drawdown is a multipurpose reservoir impoundment improvement technique. It is used to control some nuisance plants, provide access to dams, docks, and shorelines for repair and installation purposes, for fish management, for sediment consolidation and removal, and for installation of sediment covers."

A brief summary of the results from the previous Lake Toho drawdowns is presented below:

A report summarizing the effects of the 1971 drawdown (Wegener and Williams, 1974) cited decreases of organic sediment from 50 to 80%, a 16% expansion of desirable littoral vegetation, and an increase of fish-food organisms that led to improvements in the fish population. Water quality in the lake did not improve, and as a result it was recommended that all waste discharges be removed from Lake Toho and its tributaries.

In 1979, another drawdown was performed on Lake Toho, but at that time, the lake was still serving as a sewage treatment plant polishing pond, and newly established littoral zone was quickly infested with water hyacinth (Williams, 1980). In 1980, the decision was made by United States Environmental Protection Agency (USEPA) to remove all sewage plant discharges from the system, which resulted in long awaited water quality improvements (Williams, 1984). By 1988 all discharge of treated effluent into Lake Toho had ceased (Moyer, 1991).

In the 1987 drawdown, muck removal operations were implemented for the first time on Lake Toho. Fish population surveys completed in spring of 1988 indicated a 400% increase in numbers of harvestable bass found on scraped areas when compared to adjacent non-scraped sites (Moyer, 1991).

Up until 1994, all organic material removed from habitat enhancement activities in the Kissimmee Chain of Lakes was deposited on upland sites (Hulon et al., 1998). However, lack of readily available upland disposal sites caused FWC to investigate alternative measures. In-lake disposal islands were first implemented in a 1994 Lake Jackson extreme drawdown, and in a 1998 report, it was reported that in-lake disposal islands do not present water quality problems, are utilized by wildlife, and also serve as reproductive habitat for some species (Hulon et al., 1998). Data of long-term effects that spoil islands may cause is not available at this time, however in-lake disposal was identified as a concern in a May 9, 2001 letter written by the USEPA and also in letters dated August 4, 2000 and October 5, 2001 from USFWS in response to scoping for this proposed action.

3.11. PURPOSE OF WATER REGULATION SCHEDULES

The C&SF Project was designed and constructed by the U.S. Army Corps of Engineers. The local sponsor for the C&SF Project is the SFWMD. The Congressionally authorized project purposes for the C&SF Project include flood damage reduction, water supply, preservation of fish and wildlife, recreation, navigation, prevention of saltwater intrusion, and water supply to Everglades National Park. For the Kissimmee Basin Project works the local sponsor, SFWMD, provided lands, easements, rights-of-way, relocations, and dredged material disposal areas. SFWMD operates and maintains the project works in accordance with Corps approved criteria, and holds and saves the United States free from damages due to the construction or subsequent maintenance of the project, except due to the fault or negligence of the Corps or its contractors. The SFWMD is also responsible for water supply allocation from the project, unless where specified by Federal law. The SFWMD, as local sponsor, has an essential role in the development of operating rules and criteria. The C&SF Project involves the operation of a large, complex, multipurpose project. Water control plans contain regulation schedules, rule curves, and operating instructions. Water control plans must blend all the varied, and often conflicting, project purposes. Compromise among competing purposes and objectives is a basic factor in multipurpose water resources project design and operation.

In the General Design Memorandum (GDM) for the Kissimmee River Basin (1956), the plan for the Kissimmee River Basin had the following objectives:

a) Protection of lands adjacent to the lakes and along Kissimmee River from frequent and prolonged flooding
b) Provision of water supply for agricultural uses in the area around the lakes and along the Kissimmee River
c) Maintenance of lake stages at a desirable level for fish and wildlife and recreational purposes
d) Consideration of the relation and any adverse effects that improvements planned for Kissimmee River Basin might have on Lake Okeechobee, and finding means of preventing or reducing such adverse effects

Kissimmee Basin lake regulation schedules essentially represent the seasonal and monthly limits of storage that guide the regulation of water levels for the purposes of flood control, navigation, agricultural water supply, and environmental enhancement. Kissimmee Basin lake regulation schedules normally vary from high stages in the late fall and winter to low stages at the beginning of the wet season. Lake levels are lowered in the spring to provide flood control storage and fish and wildlife enhancement. The minimum levels are set to provide for sufficient flood control storage and navigation depths. The amount of seasonal fluctuation was derived by determining the effect of various water levels on flood control, low water regulation, groundwater, fish and wildlife, and recreation.

The plan developed in the design phase was to provide for removal of runoff from a design storm equal to 30 per cent of the Standard Project Flood (SPF), provide for sufficient regulation capacity for the lakes to limit the rise in lake stage during the design storm to 2 feet or less, provide sufficient capacity for Lake Kissimmee to prevent maximum stages during the SPF from not exceeding those expected under pre-project conditions, provide for navigation, provide for water control, and maintain lake levels in consideration of recreation and preservation of fishery resources. Runoff during the wet season is stored for use in the dry season. The regulation schedules take into account these varying, and often conflicting, purposes. The regulation schedules form part of the Water Control Plan for the Kissimmee River - Lake Istokpoga Basin (USACE, 1991). The proposed extreme drawdown would require that special regulation schedules be adopted for certain lakes for two calendar years.

3.12. NAVIGATION & RECREATION

A portion of the Kissimmee River Navigation Project is in Lakes Kissimmee, Hatchineha, Cypress, and Toho. The Kissimmee River Navigation Project was authorized in 1902 and consisted of "a channel 3 feet deep at ordinary low stage and 30 feet wide" from the town of Kissimmee to Ft. Basinger. The lock structure at S-61 normally permits passage of vessels with a draft of less than 6 ft. The lock has invert elevations of 43.0 ft NGVD.

The Kissimmee Chain typically has local fish tournaments that attract recreationists within and outside of Florida. For example, Bass Anglers Sportsmen Society (BASS) has held several tournaments on the Kissimmee chain. In 1997, the FWC calculated from their creel data on lake Toho that 357,617 fishing hours generated annually $4.1 million dollars for the local economy. The total economic value for East Lake Toho, Lake Toho, Lake Hatchineha, Lake Cypress, and lake Kissimmee combined annually was $13.4 million dollars.

3.13. CULTURAL AND ARCHAELOGICAL RESOURCES

Humans have occupied the Florida peninsula for at least 12,000 years. During most of this time, inhabitants of the upper Kissimmee chain of lakes region probably subsisted by hunting and gathering food resources. Agriculture did not play an important role until late pre-Columbian times. The pre-Columbian archeological record around Lake Toho reflects this land use pattern. Known archeological sites cluster on low sandy ridges along the edge of Lake Toho and on low hills near the lake. A site predictive model has been developed showing several areas of high potential for archeological sites (Poplin et al. 1997).

3.14. IN-LAKE DISPOSAL ISLANDS

In-lake disposal islands, also called wildlife islands, were first developed and constructed by FWC biologists in the 1994 drawdown of Lake Jackson (Hulon et al., 1998). As part of the permitting conditions set by DEP, FWC was required to investigate the effect that spoil islands have on water quality, vegetation, and wildlife (Allen, 1998). Wildlife and vegetation monitoring was conducted from 1 September 1994 to 30 June 1997 (Hulon et al., 1997). Monitoring results reported in the 1996-1997 Lake Kissimmee and Lake Jackson Annual Performance Report showed that over 2,600 specimens were trapped and/or observed during the three-year monitoring period. A total of 67 species were documented utilizing the wildlife islands that included 24 species of birds, (including the federally endangered wood stork and federally listed whooping crane), 19 different reptiles including many different turtles and snakes (to include the federally threatened eastern indigo snake), 15 species of mammals, and 9 species of amphibians. Vegetation monitoring during the same period was collected twice a year for three years on two of the wildlife islands and a total of 33 species were observed (Table 3e). Dog fennel (*Eupatoriam spp.*) and maidencane (*Panicum hemitomon*) were consistently the prevalent plant species. A continuous increase in terrestrial/transitional species such as pokeberry (*Phytolacca Americana)*, fleabane (*Pluchea spp.),* and hedge nettle (*Stachys floridana*) were observed up to June 1997.

Since 1994, many wildlife islands have been created to include; three islands in Lake Cypress(1998-2001), 11 islands in Lake Kissimmee (1996), one island in Lake Toho (1999), two islands in Lake Alligator (2000), three islands in Lake Lizzie (2000), two islands in Trout Lake (2000), and one island in Lake Center (2000). All of these islands are approximately 1-2 acres in size (personal communication, Marty Mann, FWC Biologist).

Prior to creating in-lake disposal islands, FWC must obtain a Department of the Army (DA) Permit from U.S. Army Corps of Engineers, Regulatory Division. The Regulatory Division coordinates with state and federal agencies and members of the public to determine the public interest prior to issuing a permit.

4. ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. See Table 1 in Section 2.0 Alternatives, for summary of impacts. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects.

4.1. GENERAL ENVIRONMENTAL EFFECTS

Since the proposed plan's deviation from normal regulation schedules would be temporary and controlled, no significant long-term effects on flood control provisions or existing land use policies are expected. Specific effects on environmental resources are addressed under specific sub-sections.

4.1.1. AREAS OF SHALLOW WATER HABITAT EXPOSED

The following information was developed to help describe the effect that the different drawdown alternatives (including the existing regulation schedule, which is no action) would have on the four lakes. The areas – which are assumed to be shallow water habitat - that would be exposed at the different water elevations (referred to as "stage") were identified for each of the alternatives based on a starting point of the high pool stage compared to the low pool stage for each lake after its winter or spring drawdown (which occurs under each of the lake regulation schedules). Shallow water habitat provides essential areas for cover, reproduction, feeding, and resting for fish, macroinvertebrates, and other species discussed later in this Section. The purpose of this sub-section is to give the reader a perspective on how the alternatives would affect these areas in each of the lakes. Individual plant and animal responses are discussed in more detail in later sub-sections.

To summarize the findings presented immediately below: around twice as much area would be exposed on Lake Toho under Alts 1 and 4w (10,300 acres would be exposed compared to 5,300 acres) than are exposed under the existing regulation schedule; for Lake Kissimmee additional areas that would be exposed for Alt 1 and 4W would be 600 acres every two of three years and 100 acres every third year; implementing Alt 1 or 4W on Lake Hatchineha would expose approximately an additional 400 acres compared to what is currently exposed every third year or an additional 500 acres compared to what is currently exposed every two years out of three years; and for Lake Cypress Alt 1 and Alt 4W would expose an additional 300 acres compared to what is currently exposed every third year or an additional 350 acres over what is currently exposed every two out of three years.

Area of Shallow Water Habitat Exposed

<u>Lake Toho</u>

Stage(NGVD)	Volume (ac-feet)	Surface Area (acres)
48.5	33,000	12,200
49.0	42,000	13,500
49.5	48,000	14,700
51.5 (no action, every 3rd yr)	76,000	17,200

52.0 (no action, every 2 of 3 yrs)	84,000	18,000
55.0 (high pool)	145,000	22,500

Results:

Alt 1: Lake area that would be exposed during drawdown = **10,300 acres**. Based on target stage (lake water level) of 48.5 ft from a beginning stage of 55.0. (Refer to Fig. 3a).

Alt 4W: Lake area that would be exposed during drawdown = **10,300 acres**. Target stage is 49.0 ft by Feb 15, then down to 48.5 ft during Feb 16 to June 1, from a beginning stage of 55.0. (Refer to Fig. 4b).

Alt 10 (No action): Lake area that is presently exposed is **5,300 acres** every one year in three years when water levels are dropped to 51.5 (refer to Figure 5b) from 55.0. Lake area exposed every two years out of three is 4500 acres when water levels are dropped to 52.0 from 55.0. (Refer to Fig. 5b).

Lake Kissimmee

Stage(NGVD)	Volume (ac-ft)	Surface Area (acres)
48	190,000	31,000
48.5 (no action, every 3rd yr)	207,000	31,100
49 (no action, every 2 of 3 yrs)	224,000	31,600
52.5 (high pool)	350,000	40,400

Results:

Alt 1: Lake area exposed during drawdown = **9,400 acres**. Target stage (lake water level) is 48.0 ft from a beginning stage of 52.5. (Refer to Fig. 3b).

Alt 4W: Lake area exposed during drawdown = **9,400 acres**. Target stage is 49.0 by Feb 15, down to 48.0 during Feb 16 to Jun 1, from 52.5. (Refer to Fig. 4c).

Alt 10 (No action): Lake area that is presently exposed is **9,300 acres** every one year in three years when water levels are dropped to 48.5 (refer to Figure 5c) from maximum desired lake level of 52.5. Lake area exposed every two years out of three is **8,800 acres** when water levels are dropped to 49.0 from 52.5. (Refer to Fig. 5c).

Lake Hatchineha

Stage(NGVD)	Volume (ac-ft)	Surface Area (acres)
48	22,500	5,600
48.5 (no action, every 3^{rd} yr)	25,500	6,000
49 (no action, every 2 of 3 yrs)	28,500	6,100
52.5 (high pool)	60,000	14,000

Results:

Alt 1: Lake area exposed during drawdown = **8,400 acres**. Target stage (lake water level) is 48.0 ft from a beginning stage of 52.5. (Refer to Fig. 3b).

Alt 4W: Lake area exposed during drawdown = **8,400 acres**. Target stage is 49.0 by Feb 15, down to 48.0 during Feb 16 to Jun 1, from 52.5. (Refer to Fig. 4c).

Alt 10 (No action): Lake area that is presently exposed is **8,000 acres** every one year in three years when water levels are dropped to 48.5 (refer to Figure 5c, DEIS) from maximum desired lake level of 52.5. Lake area exposed every two years out of three is **7,900 acres** when water levels are dropped to 49.0 from 52.5. (Refer to Fig. 5c).

Lake Cypress

Stage(NGVD)	Volume (ac-ft)	Surface Area (acres)
48	11,000	3,100
48.5 (no action, every 3rd yr)	12,500	3,400
49 (no action, every 2 of 3 yrs)	14,500	3,450
52.5 (high pool)	28,750	5,500

Results:

Alt 1: Lake area exposed during drawdown = **2,400 acres**. Target stage (lake water level) is 48.0 ft from a beginning stage of 52.5. (Refer to Fig. 3b).

Alt 4W: Lake area exposed during drawdown = **2,400 acres**. Target stage is 49.0 by Feb 15, down to 48.0 during Feb 16 to Jun 1, from beginning stage of 52.5. (Refer to Fig. 4c).

Alt 10 (No action): Lake area that is presently exposed is **2,100 acres** every one year in three years when water levels are dropped to 48.5 (refer to Figure 5c, DEIS) from maximum desired lake level of 52.5. Lake area exposed every two years out of three is **2,050 acres** when water levels are dropped to 49.0 from 52.5. (Refer to Fig. 5c).

4.1.2. SUMMARY OF BENEFITS AND IMPACTS OF THE ALTERNATIVES

The following summaries were developed to provide the reader with an overview of how the alternatives would affect the lakes and the Kissimmee River. More detail is provided in subsequent paragraphs.

Alternative 4W (preferred alternative):

Benefits to Toho:

Long-term benefits to littoral zone of increased fluctuation by lowering lake level
Long-term improved littoral zone habitat for fish and wildlife species
Long-term improved recreational fishing
Long-term improved navigation

Impacts to Toho:

Short-term loss of fish and macroinvertebrates (including apple snails) during the drawdown
Short-term impacts on endangered snail kite (being coordinated with USFWS)
Short-term water quality impacts
Short and long term impacts to aesthetics
Short-term impacts to recreation

Benefits to Lakes Cypress, Hatchineha, Kissimmee:

Benefits would be similar as what would be expected for Toho.

Impacts to Lakes Cypress, Hatchineha, Kissimmee:
Impacts would be similar as what would be expected for Toho.

Downstream Impacts (Kissimmee River):
In the dry year evaluated (modeled), target flows to the Kissimmee River were met 28% of the time. In the normal year evaluated, target flows to the Kissimmee were met 73% of the time.

Alternative 1: Basically the only differences between Alternative 1 and 4W are the benefits and impacts to the Kissimmee River.

Benefits/Impacts to Toho:
Same benefits/impacts as for Alternative 4W

Benefits/impacts to region (Lakes Cypress, Hatchineha, Kissimmee):
Same benefits/impacts as for Alternative 4W

Downstream Impacts (Kissimmee River):
In the dry year analyzed, target flows to the Kissimmee River met 20% of the time. In the normal year analyzed, flows were met 68% of the time.

Alternative # 10 (No Action alternative):

Benefits to Toho:
No short-term effect on snail kites (being coordinated with USFWS)
No short-term effect on macroinvertebrates (particularly apple snails) (being coordinated with USFWS)

Impacts to Toho
Long-term loss of recreational fishery
Long-term loss of littoral zone habitat for fish, wildlife, wading birds
Long-term decline in recreational use of lakes
Long-term decline in aesthetics
Long-term decline in navigation

Benefits/Impacts to Lakes Cypress, Hatchineha, Kissimmee:
Would be similar as what would be expected for Lake Toho

Downstream Impacts (Kissimmee River):
In the dry year evaluated, target flows to the Kissimmee River were met 27% of the time. In the normal year evaluated, target flows to the Kissimmee River were met 49% of the time.

4.2. VEGETATION

Beneficial effects associated with the drawdown plan include bottom substrate improvements as organic build-up is reduced. This would support increase in diversity and density of desirable vegetation. Scraping activities are intended to remove organic overlay in lakes, but scraping requires careful monitoring in order to protect both root systems of desirable aquatic plants and seed reservoirs within the lake bed (FWC, 1986).

The control of hydrilla, water hyacinth, and waterlettuce would continue during the time that Lake Toho is in the drawdown. The drawdown would reduce the amount of tussock mats that would form in the lake. Some loss of desirable aquatic vegetation would occur during the drawdown. However, increased control and removal of nuisance vegetation would improve the recruitment potential of desirable aquatic plants after lake refill. On refill, floating plant populations would be monitored to prevent large mats from forming and impacting the newly scraped areas. Additional treatment of nuisance plants such as spatterdock, smartweed, and non-native species like paragrass and torpedograss that re-establish in the scraped areas would be addressed on an as needed basis. The plan to efficiently control nuisance aquatic plants, before and during the drawdown, would be closely coordinated with the Kissimmee Interagency Aquatic Plant Management Group, which includes the Corps, FDEP, FWC, Osceola County, SFWMD, and members of the general public:

Under the no action alternative, the following changes would be expected to occur in the plant community:

- Increases in all lakes for lily species, smartweed, pickerelweed, and cattails
- Decreases in knotgrass, maidencane, and bulrush over time
- Stabilization to decreases in hydrilla. Hydrilla rapidly expanded through the Kissimmee Chain in the early 1990's to reach current acreages. With continued maintenance efforts, the acreage is anticipated on decreasing over time independent of drawdown projects.

In summary, there would likely be continued buildup of organic sediments and the spread of nuisance vegetation, which would result in degradation of quality habitat.

4.2.1. VEGETATION RESPONSES CONDUCTED AFTER PREVIOUS DRAWDOWNS

Work by Moyer et al. (1995) and Allen and Tugend (2001) on Lake Toho and Lake Kissimmee respectively noted similar results for post drawdown impacts. On scraped sites there was more plant diversity and initially lower plant coverage. In the control sites there were monotypic stands of pickerelweed and smartweed, which continued to have 100% coverage after the lake refilled. These control areas had low oxygen and little spawning and nursery habitat for both sport fish and forage fish. Moyer et al.

(1995) further addressed questions about the drawdown methodology namely removal of the entire sediment berm. The alternative being the creation of openings in the berm without scraping, but this would not restore the previous uses as spawning and forage areas. Also, the short-term positive responses due to drawdown projects have been documented, the long term benefits were debatable. Three years post drawdown on Lake Toho, the vegetation communities in the scraped areas reverted to dense monocultures of pickerelweed and cattails. The substrate was still hard sand, but with the aquatic vegetation returning to pre-drawdown densities, the sport fish value of the areas was low. Various techniques to maintain intermediate plant densities were being investigated. In 1994 several areas were harvested, with cattails having minimal regrowth but pickerelweed grew back almost immediately. Combinations of chemical and mechanical treatments to reduce biomass and control regrowth were also being tried. The bottom line conclusion was that a two fold management strategy that included basin wide initiatives to protect water quality coupled with continued aquatic plant management and restoration work would be necessary to provide maximum benefits to the sport fishery and its associated recreational and economic components.

4.3. POST PROJECT PLANT MANAGEMENT PROGRAM

The maintenance control program for water hyacinth and waterlettuce would be continued with special emphasis during refill to eliminate large water hyacinth populations. Hydrilla management would also continue with emphasis on areas that have responded quickly after drawdowns. The FWC and DEP would continue to work together through the Kissimmee Interagency group to assess which scraped areas would need management with chemical and mechanical means.

Monitoring and vegetation management plans would need to be implemented for the wildlife islands. However, no plans have been developed.

4.4. THREATENED AND ENDANGERED SPECIES

In letter dated June 26, 2001, from USFWS, it was determined that no adverse effect was expected to occur as a result of the proposed drawdown for the Audubon's crested caracara (*Caracara plancus audubonii*), bald eagle (*Haliaeetus leucoccephalus*), and wood stork (*Mycteria Americana*). The USFWS indicated that additional evaluation would be required to determine effects on the Everglade snail kite (*Rostrhamus sociabilis plumbeus*). By October 5, 2001, letter USFWS suggested that the Corps request initiation of formal consultation in order to address effects that the proposed drawdown may have on the snail kite. This letter stated that snail kite populations may be adversely affected by the in-lake disposal islands. Subsequent to receipt of this letter formal coordination with USFWS and FWC has been initiated and USFWS is preparing a Biological Opinion for the snail kite. Section 7 correspondence is located in Appendix G. Although incomplete at this time, coordination under the Endangered Species Act will be completed before a final decision is made on which or how a selected alternative would be implemented to ensure that endangered and threatened species are not adversely impacted by the project.

The no action alternative would have no direct effect on threatened and endangered species.

4.5. FISH AND WILDLIFE RESOURCES

4.5.1. FISHERY RESPONSES

A number of studies, both published and unpublished, have documented the effects of drawdown and muck-removal projects on fish communities. Studies are performed in a variety of methods and often survey different fish populations. Most studies report an immediate fish response with peaks in abundance and/or biomass usually occurring within 2-3 years following enhancement (Williams and Moyer, 1979; Moyer et al., 1995; Hulon et al., 1999).

In response to the 1979 drawdown of Lake Toho, largemouth bass increased to nearly 70 harvestable fish per acre in vegetated areas by fall 1983, an increase of 400% compared to the 14 bass per acre present in 1978. Black crappie, another important sport fish, had excellent reproduction and survival of young in 1980 and 1981, and by fall 1983 produced 32 harvestable fish per vegetated acre (FWC, 2000).

Following the 1987 drawdown of Lake Toho, fish production peaked at 608 pounds of fish per littoral acre in 1989, an increase of 74% when compared to 1986 data. Largemouth bass production peaked in 1989 with 93 pounds per littoral acre, up from the 29 pounds per acre collected in 1986 (FWC, 2000).

Following the 1990 enhancement of East Lake Toho, electrofishing catch rates of panfish (*Lepomis spp.*) and largemouth bass peaked within two years (Moyer et al., 1996).

According to FWC, similar fisheries responses to those observed after the Lake Kissimmee Drawdown would be expected after the Lake Toho drawdown. Evaluation of the 1996 Lake Kissimmee Habitat Enhancement Project included assessment of the largemouth bass population. Annual electrofishing surveys conducted by Florida Fish and Wildlife Conservation Commission biologists have indicated an increase in the relative abundance, based on qualitative samples, of largemouth bass in Lake Kissimmee (Figure 2a). During 1998 and 1999, the highest average catch-per- unit-effort (CPUE) was documented at 107 fish/hour and 112 fish/hour, respectively, since 1992. The high CPUE was attributed to two strong year classes produced during 1997 and 1998 that were sampled at age-1 during 1998 and 1999. The 1997 and 1998 year class should produce an excellent fishery as they recruit to larger size classes. The strong 1997 and 1998 year classes were confirmed by Dr. Mike Allen of the University of Florida, Department of Fisheries and Aquatic Sciences in a largemouth bass age and growth study conducted during 2000-2001. In this study, Dr. Allen demonstrated that the percent contribution of the 1997 and 1998 year class to the age structure of the population was as high as the 1999 year class (table 8). This is significant as the 1997 and 1998 year class suffered an additional one to two years mortality. Those results indicate that the 1997 and 1998 year classes were strong with 1997 being the strongest. This phenomenon is similar to past drawdowns and habitat enhancement projects on Lakes Toho, Jackson and Kissimmee.

Dr. Mike Allen also investigated the effects of habitat enhancement on age-0 largemouth bass abundance at Lake Kissimmee. Dr Allen found that habitat quality improved with an increase in aquatic macrophyte species richness and diversity. He also reported that a reduction I organic substrate, macrophyte biomass and coverage improved water quality (dissolved oxygen) and largemouth bass density in enhanced sites. However, sampling unenhanced sites (control areas) yielded no largemouth bass or other sportfish species in any year (figure 2b).

These results are consistent with past projects on lakes Toho, Jackson and Kissimmee. This summary is the most recent information that demonstrates the positive effects that drawdowns and habitat enhancement projects have on the Kissimmee Chain of Lakes.

4.5.2. WATERFOWL AND WILDLIFE RESPONSES

Lake littoral zones are important for over wintering waterfowl such as American coot (*Fulica americana*), ring-necked duck (*Aythya collaris*), Northern pintail (*Anas acuta*) and blue-winged teal (*Anas discors*). The native Florida or mottled duck (*Anas fulvigula*) also feeds in the shoreline marshes and breeds in the adjacent prairies. Wading birds including great and snowy egrets (*Casmerodius albus, Egretta thula*), great blue heron (*Ardea herodias*), tricolor heron (*Egretta tricolor*), little blue heron (*Egretta caerulea*), and limpkin (*Aramus guarauna*) feed on forage organisms normally abundant in the shallows. Numerous species of amphibians and reptiles also inhabit these waters; most notable among them is the American alligator (*Alligator mississippiensis*). Game animals using the lake and adjacent land include white-tailed deer (*Odocoileus virginianus*), wild hog (*Sus scrofa*), wild turkey (*Meleagris gallopavo*), quail and dove. After habitat enhancement activities, littoral zones may be improved and may again provide the important forage base on which many of these wildlife and waterfowl depend for survival.

According to USFWS comments provided under the Endangered Species Act (letter dated October 5, 2001) apple snails (*Pomacea paludosa*), the primary prey for the Everglade snail kite, may be negatively affected by drawdown activities. Darby *et al.* (1998) observed > 80% mortality during a drawdown on Lake Kissimmee in 1996 and 1997 of approximately 5.5 feet for approximately five months. Loss of recruitment and mortality is expected to result in a two to three year reduced availability of the apple snail as a food source for the snail kite.

4.5.3. MACROINVERTEBRATE RESPONSES

Macroinvertebrates are important prey items for sport fish, particularly in the early stages of life (Williams & Moyer, 1979; Allen & Tugend, 2001). Therefore, changes in these communities may indirectly affect the fish population (growth and survival).

Studies on Lake Toho have shown that the simplest and most economical method for manipulating aquatic and vegetation communities to increase abundance and production of macroinvertebrates is through extreme water fluctuation during the plant growing season (Wegener, et al. 1974). Wegener reported that after an extreme drawdown was performed in 1971 on Lake Toho, there was improved littoral substrate, stimulated development of aquatic macrophytes and increased invertebrate standing crop. Benthic macroinvertebrates increased from 98 to 244 organisms per square foot in limnetic areas after reflooding; littoral benthos rose from 154 to 250 organisms per square foot. Phytomacrofauna increased from a pre-drawdown high of 304, to 1364 organisms per sample unit after reflooding. Standing crops decreased to pre-drawdown estimates within two years following peak production periods. These decreases were attributed mainly to predator cropping. Fish food organisms were favored by the drawdown, and their incidence in largemouth bass stomach increased. As a final expression of increased production, sportfish populations which utilized these organisms nearly doubled. The above studies were performed before scraping methods were utilized.

In 1987, an extreme drawdown was performed on Lake Toho, and scraping methods were utilized. Sampling for littoral invertebrates by dip net and corer during 1988 and 1989 was performed (Butler, et al. 1992). Butler reported that the numbers of invertebrates (densities and taxa) associated with macrophytes in restored areas were less than they were in undisturbed (control) areas in 1988. One year later (1989), the densities of these invertebrates were greater in restored areas, but the number of taxonomic megagroups (families, orders, or classes) were still higher in control areas. The densities of bottom-dwelling (corer samples) invertebrates were consistently greater in the restored areas for both years. Chironomidae and Oligochaeta comprised more than 29% of the total invertebrate population. Important groups also included Palaemonidae, Coenagrionidae, Baetidae, Caenidae, Hyalellidae, and Hydrophilidae. The observed changes and differences in the invertebrate communities were generally attributed to changes and differences in macrophyte densities, ratios of submerged-floating to emergent plants, concentration of dead vegetation, ratios of air-breathing to gill-breathing invertebrates, and fish predation. Fish predation was probably the single most important factor in shaping the restored invertebrate community.

Studies conducted on the 1990 enhancement of East Lake Toho showed macroinvertebrate densities peaked one to two years following reflooding (Moyer et al.

1996). Butler et al. (1992) suggests that macroinvertebrate communities are influenced by macrophyte density and type, biological needs of the organisms, amount of dead plant material, and fish predation. Thus, differences in these variables through time following an enhancement likely affect the community composition of macroinvertebrates.

4.5.4. US FISH AND WILDLIFE SERVICE RECOMMENDATIONS UNDER THE FISH AND WILDLIFE COORDINATION ACT

The US Fish and Wildlife Service submitted comments on the project in accordance with the Fish and Wildlife Coordination Act by letter dated October 5, 2001 (refer to Appendix G). The letter listed the following concerns which should be addressed during the permit (modification) process: 1) the in-lake disposal islands being a source of nutrients, 2) the presence of cattle on the spoil islands, 3) a re-vegetation plan for the disposal islands, 4) the spoil islands trapping sediment between the islands and shorelines, 5) a health advisory for limited consumption of largemouth bass, bowfin, and gar and the potential detrimental impacts of leaving this material in the lake as spoil islands, 6) questioned if the islands provided habitat for existing wildlife populations or would augment existing populations, and 7) questioned whether public access would be allowed on the islands.

The letter also recommended the following be provided for future lake management efforts: 1) an analysis of in-lake disposal islands in the Kissimmee Chain of Lakes be prepared by the applicant, 2) monitor bald eagle primary and secondary nesting zones so construction activity would avoid them, 3) develop a long term (50+) management plan for Lake Toho to determine if in-lake disposal will be an option, 4) if in-lake disposal is an option then a) develop a monitoring plan for erosion, water quality, apply snails, and b) exotic and nuisance vegetation control plan, c) develop a re-vegetation plan for native plants, d) develop and plan for public access on disposal islands, e) prevent future cattle access to spoil islands, 5) offer to assist in future studies particularly concerning plants and animals, and 6) recommends that an interagency effort be developed to evaluate to project - especially the water quality, muck re-accumulation aspects of it.

The conclusion of the letter is that the Fish and Wildlife Service supports lake habitat enhancement activities that clearly demonstrate benefits to the lake and surrounding ecosystems in which both long term and short term enhancements are considered. The letter recommends upland disposal as having the greatest benefits that would reduce the frequency of future muck removal projects.

4.5.5. IN-LAKE DISPOSAL SITES

FWC plans to use upland disposal sites as well as in-lake disposal during the drawdown. Permits used to create in-lake disposal islands are obtained from the U.S. Army Corps of Engineers, Regulatory Division. Before the permits are issued, the Corps coordinates actions with state and federal agencies. The following is a summary of work that is proposed by FWC for each lake and will be evaluated during the permit review process (see also section 1.8):

4.5.5.1. Lake Toho

FWC has been issued a permit that authorizes up to 4 million cubic yards of muck removal and create up to 47 in-lake disposal sites (see Section 1.8 and Appendix A for more details on this permit). There are 29 upland disposal sites authorized. FWC had requested a modification of the already existing permit to include and additional 2.7 million cubic yards of muck and 2 additional islands (for a total of 49 islands).

Upland disposal sites are being pursued by FWC staff. Letters have been written to Osceola County for identification of upland disposal. Florida Department of Transportation (DOT) has also been contacted about using muck removed as part of road or mitigation projects in nearby areas. Ranchers that own large tracts of land around the lake would be contacted as soon as project schedule is in place.

4.5.5.2. Lake Kissimmee

No work is scheduled for Lake Kissimmee during the drawdown. Work to be completed on Lake Kissimmee in the future consists of minor scraping to touch up where the shoreline was scraped in 1996. This work would involve no new island creations and is not currently scheduled, but may occur 2-4 years from now.

4.5.5.3. Lake Cypress

FWC has submitted a permit request to remove 1.4 million cubic yards of material from Lake Cypress. Twenty in-lake disposal islands have been requested in the permit application. There is a tentative plan to dispose some material on upland property around Lake Cypress. Verbal commitments have been made with land owners, but in-lake disposal would have to be an option to complete the job.

4.5.5.4. Lake Hatchineha

FWC has submitted a permit request to remove 3.5 million cubic yards of material from Lake Hatchineha. Forty in-lake disposal islands have been requested in the permit application.

4.6. SURFACE AND GROUNDWATER

4.6.1. SURFACE WATER WITHDRAWALS

Withdrawals of surface water and groundwater for consumptive use in the Upper Kissimmee Basin are regulated by the SFWMD through part II, 373, F.S. Consumptive use permits are not required for water withdrawals for consumptive use by individual domestic users. SFWMD staff has researched current domestic and agricultural water users in Lake Toho, Lake Hatchineha, Lake Cypress and Lake Kissimmee. There are three existing water use permits utilizing surface water from Lake Toho; one water use permit utilizing Lake Hatchineha surface water and one water use permit utilizing Lake Kissimmee surface water. SFWMD staff is assisting the FWC by surveying the intake elevations of the permitted surface water withdrawal facilities (existing legal users) to determine the potential for adverse impacts to the existing permitted users due to the proposed lake drawdown. It may be necessary for the FWC, as lead local sponsor to mitigate these impacts, if it is determined that the proposed water levels would impair the ability of the existing legal user to withdraw water with the permitted facility. SFWMD staff is currently assisting FWC to contact these landowners to inform them of the proposed drawdown plans. SFWMD staff has also determined that a number of homeowners on all of the lakes use surface water withdrawals to irrigate their property. These water users may need to extend their pump intakes farther out into the lakes or temporarily use an alternate water supply source, due to the drawdown.

4.6.2. POTENTIAL NEED FOR INCREASED IRRIGATION

A majority of the permitted water withdrawals by domestic and agricultural water users in Lake Toho, Lake Cypress, Lake Hatchineha and Lake Kissimmee area are made from the Surficial aquifer or the Floridan aquifer. However, the temporary lowering of water levels in the lakes due to the proposed drawdown may require some agricultural interests to be mitigated to ensure a water supply source for their permitted irrigation needs. This potential mitigation may require a modification to the existing water use permits.

4.6.3. GROUNDWATER MODELING ANALYSIS.

The SFWMD has submitted a report entitled, "Integrated Surface and Groundwater Model (ISGM) for Lake Tohopekaliga Drawdown Project." Volume II of the EIS contains this report. The objective of the analysis was to develop an ISGM with the ability to predict potential impacts on the groundwater levels of the surficial aquifer due to implementation of the Lake Toho drawdown project. The proposed drawdown project would temporarily lower Lake Toho water levels to elevation 48.5 feet in comparison to the normal regulation schedule that varies between elevation 52 to 55 feet.

The Danish Hydraulic Institute, Inc. (DHI) and GeoModel, Inc. prepared the report under contract to the SFWMD. The Lake Toho ISGM is based on the MIKE/SHE model results have been proven consistent with other studies conducted in the project area focusing on actual evapotranspiration and vertical flows to and from the Upper Floridan aquifer. . Thus, the modeling system, devloped by DHI Water and Environment. The MIKE/SHE modeling system is an integrated hydrologic modeling system that describes the land phase of the hydrologic system including coupled surface water and groundwater. Figure 1-1 represents the project area covered by the MIKE/SHE model. The hydraulic model component (MIKE11) of the Lake Toho ISGM includes all major lakes and related hydraulic control structures. It also contains the major tributaries in the project area (Boggy Creek, Shingle Creek and Reedy Creek). Moreover, it includes Fanny Bass Creek and Fanny Bass Pond which are located next to the Sunset Fish farms. Figure 3-7 indicates the major lakes, canals and tributaries represented in the MIKE 11 hydraulic model.

The Lake Toho ISGM combines available field data within the project area in an integrated modeling framework based on the MIKE SHE modeling system. The model has been calibrated and verified against field data comprising both groundwater level data and surface water flow and stage data. The model generally has the ability to reproduce measured groundwater levels within a precision of about 1 foot. The uncertainty on predicted runoff is generally within 10-20%. Considering uncertainties in meterological data and in runoff measurements this is considered a reasonable uncertainty on predicted runoff. Moreover, the model has demonstrated the ability to reproduce both measured stage data as well as the overall water balance within the project area. The model appears to be scientifically sound, consistent and reliable with the ability to predict hydrologic impacts from stresses such as those resulting from drawing down Lake Toho. Model calibration and verification is described in Volume II, Section 4 as well as presented graphically in Appendix F. Particularly useful are Figure 4-10 (Wells used for Model Calibration) on page 4-22 and Table 4-4 (Groundwater Calibration Statistics, Regional Model) shown on page 4-27.

The ISGM has been applied to study potential impacts of the Lake Toho drawdown for different scenarios. These scenarios are composed of 5 different climatic conditions representing different combinations of dry, normal and wet conditions. Each climate scenario has then been simulated with and without the lake drawdown. These scenarios are described in Volume II, Table 5-1 shown on page 5-2. Of the 10 scenarios, A.1 and B.1 represent the most severe hydrologic conditions (normal/drought/drought) concerning potential impacts to groundwater levels surrounding Lake Toho. Figure 5-3 contains a map indicating the approximate extent of projected impacts to the water table aquifer due to the proposed drawdown. This map represents the simulated difference in groundwater level between scenario A-1 (normal regulation scenario) and scenario B-1 (Drawdown scenario) on June 29 of the second calendar year of the drawdown.

Modeling results showing predicted stages for Lake Toho as well as predicted groundwater levels for three critical well locations (Toho 1, Toho 2, Sunset) under the 10 scenarios are presented in Figures 5-1 through 5-14. Figure 5-2 shows the predicted groundwater levels at the three well locations under the most severe conditions, A.1 (no drawdown) and B.1 (with drawdown) scenarios. Note that the maximum impact to groundwater levels (vertical difference between graphed lines) is predicted to be less than 1 foot at Toho 1; less than 0.5 feet at Toho 2; and essentially 0 feet at Sunset, a groundwater monitoring well located adjacent to Sunset Tropical fish farm.

The above results were obtained from the regional scale model, utilizing a 1000-foot grid size. An additional simulation for the most severe climatic scenarios, A.1 and B.1, was also conducted using a more detailed local model (200-foot grid size) of the Fanny

Bass Pond area. The results of the local scale model scenario confirm the findings of the regional scale model, namely that the lake drawdown would not impact the groundwater level at distances (approximately 10,000 feet) from the lake at which facilities, such as the fish farms, are located. Results of the local model simulation are discussed in Volume II, page 5-22 and displayed graphically on Figures 5-15 and 5-16.

Two sensitivity runs were conducted for scenarios A.1 and B.1 in order to determine the effect of increasing the horizontal hydraulic conductivity(K_h) of the surficial aquifer by factors of 2 and 5. K_h is the key parameter controlling the extent of the groundwater impact zone within the aquifer. Increasing K_h by a factor of 5 leads to aquifer properties similar to those of a gravel aquifer (500-600 feet/day), which is far beyond the realistic values for the surficial aquifer (comprised mostly of medium to fine-grained sands) in the Lake Toho area. Under this exaggerated circumstances, a small impact (0.2 feet) is predicted at the Sunset Tropicals location. Increasing K_h by a factor of 2 results in essentially no impact at Sunset Tropicals. Increasing K_h by a factor of 5 leads to highly unrealistic aquifer properties that results in a substantial overestimation of the groundwater impact zone. The scenario, however, demonstrates that the fish farm, Sunset Tropicals, is located so far outside the actual drawdown influence zone that it requires highly unrealistic aquifer properties to produce any observable impact on the simulated groundwater table at the farm. Results of the sensitivity runs at the Toho 1, Toho 2 and Sunset well locations are depicted in Volume II, Figures 5-17 and 5-18.

In summary, the modeling results for the different scenarios clearly demonstrate that the drawdown's area of influence around the lake is limited. The impact zone would not extend beyond 5,000-6,000 feet from the lake shoreline and even horizontal hydraulic conductivites well beyond a realistic level would not cause the drawdown's cone of influence to extend as far as Sunset Tropicals, located about 10,000 feet from the Lake Toho shoreline. Climatic conditions (i.e., rainfall, evapotranspiration), rather than the water level in Lake Toho, control the groundwater levels at this and other locations farther from the lake.

4.7. SPREADSHEET ANALYSIS OF STAGES AND DISCHARGES

Computer spreadsheets were developed to provide an understanding of the lake levels and S-65 discharges possible when historical lake inflow data is applied to specific operational criteria. Separate spreadsheets were developed for Alternative 1, Alternative 4w, and Alternative 10 that span a 19-month period beginning 1 November and ending 31 May. For Alternatives 1 and 4w, this period includes proposed lake drawdowns to facilitate the Lake Toho Environmental Enhancement Project. The historical inflow data included a “normal year” and a "dry year". The “dry year” was represented by data from 1 November 1999 to 31 May 2000 and from 1 June 1998 to 1 June 1999. The “normal year” was represented by data from 1 November 1996 to 31 May 1997 and 1 June 1996 to 1 June 1997. These dry and normal years were based on "drought" and "normal" periods, respectively, used in the DHI report, "Integrated Surface and Groundwater Model for Lake Toho Drawdown Project, June 2001". Further background on the "drought" and "normal" periods may be found in Section 5 of the Lake Tohopekaliga Extreme Drawdown and Habitat Enhancement Project, Draft EIS, Volume II. The specific operational criteria used in the spreadsheets reflects the Alternatives 1, 4w, and 10 as previously described in Section 2.1 and includes: approved lake regulation schedules contained in the Kissimmee River-Lake Istokpoga Basin Water Control Plan (Alternatives 1 and 10), proposed lake regulation schedules (Alternative 1 and 4w), the Interim Operating Schedule for Lake Kissimmee (Alternatives 1, 4w, and 10), and the historical 90% flow at S-65 (Alternatives 1, 4w, and 10). The historical 90% flow at S-65 is the average monthly flow out of Lake Kissimmee that was exceeded 90% of the time during the period of record 1934 - 1960. The spreadsheets provide a daily estimate of S-65 discharges and stages at Lakes East Toho, Toho, and Kissimmee. For the determination of downstream effects, the historical 90% flow at S-65, or the target flow, represents the minimum desirable daily flow criteria and would be compared to the spreadsheets daily estimates of S-65 flow.

4.8. EFFECTS ON FLORIDAN AQUIFER

The USGS has classified most of the Lake Toho, Cypress, Hatchineha, and Kissimmee area as an area of generally no to very low recharge to the Floridan Aquifer as shown on Figure 6 (Shaw and Trost, 1984). In light of this fact, it is estimated that in general, water levels in the Floridan Aquifer could be at most only slightly reduced as a result of the proposed drawdown.

4.9. DOWNSTREAM EFFECTS (KISSIMMEE RIVER)

Construction activities of other Kissimmee River Basin projects would be coordinated with the drawdown plan so as to avoid schedule conflicts. The estimated volume of water that would be sent downstream from Lakes Toho, Cypress, Hatchineha, and Kissimmee during the water level lowering from November to mid-February would be roughly 328,000 acre-feet. This estimate is based on stage-storage relationships and utilizes the regulation schedule of Alternative 1, which has a greater initial water level lowering for Lake Toho and Lake Kissimmee, Hatchineha, and Cypress than in Alternative 4w. This amount of water would raise the stage in Lake Okeechobee approximately 0.8 ft. However, this amount of water would not be placed instantaneously in Lake Okeechobee but rather would be discharged out of S-65 over a period of about 90 days. This amount of water corresponds roughly to an average rise in the stage of Lake Okeechobee of 0.01 foot per day.

The Kissimmee River is located downstream of Lake Kissimmee and impacted by flows through structure S-65 (refer to location map). Discharge criteria at S-65 have been developed for the Kissimmee River to minimize impacts to the restored portions of the

river, located downstream of Lake Kissimmee. The historical 90% of flow through S-65 is the average monthly flow from Lake Kissimmee that was exceeded 90% of the time during the period of record 1934 - 1960. Minimum desirable daily flow criteria at S-65 were identified as follows, based on the period of record flows: Jan - 530 cfs; Feb - 530 cfs; Mar- 445 cfs; Apr - 375 cfs; May - 300 cfs; Jun - 250 cfs; Jul - 300 cfs; Aug - 340 cfs; Sep - 390 cfs; Oct - 620 cfs; Nov - 645 cfs ; Dec - 575 cfs. Based on these desirable criteria, results for the alternatives are as follows:
Alternative 1: In the dry year evaluated the target flow to the Kissimmee River was met 20% of the time. In the normal year evaluated, the target flow was met 68% of the time.
Alternative 4W: In the dry year evaluated, the target flow was met 28% of the time. In the normal year modeled, the target was met 73% of the time.
Alternative 10: In the dry year, the target flow was met 27% of the time. In the normal year modeled, the target flow was met 49% of the time.

Alternative 4w would be expected to have minimal potential downstream impacts within the Kissimmee River restoration project area. This conclusion is based on the rate at which Lake Kissimmee stages are projected to recover during a "normal" wet season following the drawdown, and the associated projected discharges to the river, which indicate that there would be short and infrequent periods of no outflow from the Lake and that the 90% flow criteria would generally be met most of the time. Although the "normal year" spreadsheet output suggests low lake stages, and low and frequent no flow periods during the dry season after the drawdown, water could be managed so as to be available during the wet season to alleviate these potential impacts. Less consideration was given to the "dry year" spreadsheet output because any downstream impacts within the restoration project area would likely occur to at least some degree even without the drawdown, especially given the limitations of the current flood control regulation schedule for Lake Kissimmee. However, there may be impacts within the restoration project area (discussed below) if there are frequent and extended periods of no inflow to the restored river, whether due to an extremely dry year or less rainfall than modeled in the normal year spreadsheet analyses.

A calculation in the Spreadsheet Analysis was performed to determine the number of consecutive days equal to or greater than 7 when S-65 flow was zero over the time period from 1 April thru 30 September. Here are the results:
Alternative 1: In the dry year modeled, 183 and 61 consecutive days of zero flow at S-65. In the normal year modeled 27, 17, and 30 consecutive days of zero flow at S-65.
Alternative 4w: In the dry year 7, 163, and 61 consecutive days of zero flow at S-65. In the normal year 10, 14, and 8 consecutive days of zero flow at S-65.
Alternative 10: In the dry year 7, 115, and 57 consecutive days of zero flow at S-65. In the normal year, 14 and 13 consecutive days of zero flow at S-65.

Prolonged periods of no flows, worse conditions than predicted by the above model results, would have the following impacts on the Kissimmee River. Fish habitat would be impacted by depressed dissolved oxygen concentrations, particularly during the late spring - summer months. Growth of in-channel vegetation, including exotic species, would expand. The floodplain would be drained which would allow for colonization and growth of upland and mesophytic plant species where wetland plant communities have been reestablishing. This would limit, if not preclude, use of the floodplain by large riverine fish for spawning and nursery habitat and by wading birds and waterfowl.

4.10. WATER QUALITY

4.10.1. LAKE TOHO

The proposed action of lowering the lakes should not adversely impact the existing water quality and State of Florida water quality standards should be met. In-lake disposal will be addressed during the permit process; however, it is anticipated that contaminants would not be introduced from the existing muck and vegetative tussocks when moved to the inlake disposal sites. Short-term increases in turbidity are expected during the removal and disposal operations phase of the project; however the system would re-establish itself as a productive part of the overall ecosystem. Reduction of excess organic material would decrease chemical oxygen demand resulting in more stable and higher dissolved oxygen levels in the lake. Water clarity would also improve and light penetration would subsequently increase. The expected increase in light penetration should encourage phytoplankton growth and productivity with an accompanying increase in zooplankton and higher-level forage organisms. No long-term surface water quality problems would result and an overall benefit to the area should occur.

4.10.2. DOWNSTREAM EFFECTS

The net increase of phosphorus loads delivered to Lake Okeechobee via the Kissimmee River (C-38) as a result of the Lake Toho drawdown should be near zero. This is based on the assumption that the release of water down the Kissimmee River Channel during the drawdown of lakes Lakes Toho, Kissimmee, Hatchineha, and Cypress would be balanced by the need to refill the lakes at a later date. Additionally, the removal of nutrient laden lake soils and vegetation would reduce future nutrient contributions from Lake Toho to Lake Okeechobee. Moreover, the long-term benefits for enhanced water storage and water quality improvements should outweigh the potential short-term, temporary water quality impacts of the proposed extreme drawdown on the Total Maximum Daily Load for Lake Okeechobee (refer to DEP letter in Appendix F).

4.11. HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Given the present and past land uses, there is little chance that the sediments contain pesticide or heavy metal contaminants at concentrations that exceed normal background for central Florida lake sediments. A Tier 1 evaluation of the possibility of sediment contamination was performed by comparing regionally available data with expected conditions. The FWC collected sediment samples from Lake Toho in 1986 and analyzed the samples for heavy metal contamination. The laboratory results indicate that the concentrations of Cadmium, Lead, and Mercury in these sediments are 4 to 300 times lower than the Florida State Criteria for Clean Soils (Chapter 62-775.400). Concerns were also raised over placing dredged sediments from the lake bottom back into the lake as wildlife islands. FWC has been conducting tests on these sediments, and analysis of the samples indicates that heavy metal contaminants are not present in levels that exceed U.S. Environmental Protection Agency (EPA) Region IV Sediment Screening Criteria for hazardous waste sites, or Florida Department of Environmental Protection (FDEP) Soil and Sediment Cleanup Goals Criteria. Therefore, it has been determined that excavation and placement of these materials should not cause degradation of water quality. The sediments quality is being fully evaluated as part of the Department of Army permit process. This process would be completed before any work is initiated.

4.12. AIR QUALITY AND NOISE

Some temporary local increase in particulate and hydrocarbon emissions is expected during the muck removal operations due to the use of heavy equipment. All applicable air quality regulations would be implemented to minimize these effects. The operation of machinery would also create additional noise that is likely to disturb some residents living adjacent to the lake during daytime working hours. Once the project is completed, air quality and noise should be the same as before the project conditions.

4.13. AESTHETICS

Implementation of Alternatives 1 or 4w would require use of heavy equipment for the duration of the work that would have a temporary negative impact on the aesthetics (visual resources) of the project area. Creation of in-lake disposal islands, however, may have a permanent impact on the aesthetic resources. Some individuals would like the islands, others would not like them – it would be largely a matter of personal preference. Refer to the permit (Appendix A) drawings for location of the disposal islands.

4.14. NAVIGATION & RECREATION

Adverse impacts would include a temporary decrease in navigability in Lake Toho and other lakes down through Lake Kissimmee resulting in decreased boater access to the lakes from their perimeters. These impacts would begin around December of the first calendar year of the drawdown, with increased access beginning sometime after refilling commences in June of the second calendar year. The lock structure at S-61 normally permits passage of vessels with a draft of less than 6 ft. The lock has invert elevations of 43.0 feet, NGVD. During the proposed drawdown, and for some time after refilling commences in June, there would be times when water levels at the lock are low enough that the available navigational depth through the lock is reduced. Temporary navigation restrictions on the lakes and on access between Lake Toho and Lake Cypress, with accompanying inconvenience to anglers and possible loss of revenue to fish camp operators, are unavoidable. The USACE plans to issue a Notice to Navigation Interests in advance of the scheduled drawdown to alert boaters of the temporary decrease in navigability.

Access in the main bodies of Lakes Toho, Kissimmee, Hatchineha, and Cypress would be impacted as lower water levels would limit recreational boating. However, the proposed drawdown stages for Lake Kissimmee, Hatchineha, and Cypress in Alternatives 1 and 4w are at or relatively close to the low pool (end of May) stages in the existing Lake Kissimmee regulation schedule. Since the purpose of this project is fisheries and habitat enhancement, there is expected to be a long-term benefit and overall improvement to navigation and recreation on Lake Toho via the reduction of floating tussocks and an increase in fisheries.

If it appears that during the Lake Toho extreme drawdown or refill periods there would be a temporary decrease in navigability on the restored section of the Kissimmee River between S-65A and S-65C, then a Notice to Navigation Interests would be issued to alert boater of the situation. In Section 9.8.9 of the report titled *Environmental Restoration, Kissimmee River, Florida, Final Integrated Feasibility Report and Environmental Impact Statement* dated December 1991, it was stated that: "Channel depths in the restored river will depend on the availability of flowing water; thus, wet and dry seasons will have an effect on navigation. During extremely dry periods, the three-foot channel depth for navigation may be reduced due to low flows".

4.15. EFFECT ON LAKEFRONT PROPERTIES

The lowering of lake levels would expose some bulkheads located on adjacent properties. A drawdown could increase the load on the bulkheads. Structures that are dilapidated and in need of repair could experience structural problems when the water level is lowered. The period of low water levels would be a good opportunity for property owners to do repair work on these structures. The lowered lake levels should not jeopardize bulkheads that are in good condition. Landowners that wish to do work while the water levels are low must obtain appropriate permit from FDEP or the Corps Regulatory Division.

4.16. CULTURAL AND ARCHAELOGICAL RESOURCES

The habitat enhancement project may adversely affect potentially significant archeological resources. The FWC would retain an archeological consultant to develop a plan for the protection of significant resources during the enhancement project. The consultant would identify areas that may contain significant resources, and those areas would be avoided. The archeological consultant would periodically be on site to monitor the project. The consultant would develop a short informational training session for the enhancement project equipment operators explaining what significant resources may be encountered, and what procedures to follow if potentially significant resources are found. The consultant would be FWC's point of contact for archeological and cultural resources issues. Incorporating these conditions into FWC's habitat enhancement work, the Corps has determined that the project would not effect on historic properties listed on or eligible for listing on the National Register of Historic Places. In a letters dated December 15, 2000 and October 26, 2001, the Florida State Historic Preservation Officer laid out these conditions and concurred with this determination. This determination is made according to the guidelines established in 36 CFR Part 800 and in compliance with Section 106 of the National Historic Preservation Act.

4.17. SOCIO-ECONOMIC

This section discusses the economic effects of the preferred ecosystem restoration plan. The economic discussion of the preferred plan includes five principal elements:

1. Socio-economic profile of the study area
2. Anticipated effects of preferred pan on the National Economic Development (NED) account: The preferred plan could result in positive or negative effects on net national economic efficiency due to project-induced impacts on the following economic activities in the study area:

- Freeze protection for crops,
- Damage to bulkheads,
- Water supply,
- Recreational navigation, and
- Commercial and recreational fishing.

3. Evaluation of project costs: Project costs include all expenditures required to implement a plan. Project costs include those for initial construction; lands; relocations; rights of way; rehabilitation, replacement, and repair; and operations and maintenance (O&M, including the costs of post-construction monitoring and adaptive management).

4. Regional Economic Development (RED) effects: The potential RED effects of the alternative plans include changes in income, employment, or economic output of the region.

5. Other Social Effects (OSE): The potential social effects of the alternative restoration plans include effects on minority, elderly, and disadvantaged groups, population displacement, and effects on community cohesion.

This economic assessment was conducted consistent with Federal statutes and Corps policy. Procedures for estimating NED and RED effects are specified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council, 10 May 1983), Engineering Regulation (ER) 1105-2-100 (April 2000), and other Corps guidance.

4.17.1. SOCIO-ECONOMIC PROFILE OF THE STUDY AREA.

The study area is within Osceola County, Florida. Osceola County is within the Orlando Metropolitan Statistical Area (MSA). The largest cities in Osceola County are Kissimmee and St. Cloud. The City of Kissimmee is located just north and adjacent to Lake Toho. The urbanization of Osceola County has increased significantly over the past 30 years because of its proximity to Walt Disney World that debuted in 1971 and other major tourist attractions in adjacent counties. The population of the county more than doubled from 1980 to 1990 and increased more than 60 percent from 1990 to 2000. The estimated 2000 census population of the county was 172,500 persons. Table 9 compares the population characteristics of the state of Florida and Osceola County.

Cattle raising continues to be a important part of the county's economic base. In 2001 there were nearly 100,000 head of cattle in the county ranking third in the state. According to the 1995 Florida Almanac the city of Kissimmee had been known as the "cow capital of Florida" and cattle raising covered two-thirds of the county.

In 1999, Osceola had a per capita personal income (PCPI) of $19,740. This PCPI ranked 43rd in the State, and was 71 percent of the State average, $27,781, and 69 percent of the national average, $28,546. The 1999 PCPI reflected an increase of 3.5 percent from 1998. The 1998-99 State change was 3.2 percent and the national change was 4.5 percent.

Table 10 displays employment data classified according to the 1997 North American Industry Classification System (NAICS) for Osceola County. NAICS supersedes the Standard Industrial Classification (SIC) used in reports from prior censuses. Statistics include the number of establishments; employment; payroll; and value of sales, receipts, revenue, or shipments for establishments with paid employees. The largest numbers of employees in the county are found in the Accommodation and Food Services sector with over 152,000 employees in over 420 establishments.

4.17.2. ANTICIPATED EFFECTS OF PREFERRED PLAN ON THE NATIONAL ECONOMIC DEVELOPMENT (NED) ACCOUNT

The negative impacts of the preferred plan are expected to be minimal given the short time period of the preferred drawdown. The impacts of the freeze protection, bulkhead impacts, navigation and recreation are discussed in more detail in other sections of this

EIS. Commercial and recreational fishing would be impacted by lack of access to boat ramps and fish camps. Fish camp operators and fishing guides would be negatively impacted until lake levels can be restored. Some of these losses would be made up in other parts of the State. The proposed drawdown would not impact municipal and industrial water supply (M&I) but if agricultural interest are using water from the lakes to irrigate the irrigation lines may have to be lengthened.

4.17.3. EVALUATION OF PROJECT COSTS

Project costs include all expenditures required to implement the preferred plan. Project costs include costs of removal of 6.7 million cubic yards of muck, wildlife study and in-lake island disposal evaluation, and an apple snail study. The cost of each component follows.

Muck Removal
It has been estimated to cost no more than $1.50 per cubic yard for muck removal and placement based on recent bids for similar work.
6,700,000 cubic yards X $1.50/cubic yard = $10,050,000

The Florida Fish and Wildlife Conservation Commission currently has $5.7 million budgeted for muck removal and placement. If no other additional funds are made available it is possible that $5.7 million would be spent for muck removal. If additional sources of revenue were found the total expenditure would not exceed the $10,050,000 estimate.

Wildlife Study and in-Lake island disposal evaluation $300,000

Apple Snail study $24,000

The total project cost is expected to range between $6,024,000 and $10,824,000.

4.17.4. REGIONAL ECONOMIC DEVELOPMENT (RED) EFFECTS

The regional economic development (RED) effects would be the economic consequences of preferred restoration plan on the regional economy of Osceola County and central Florida. It is expected to around take 4 months to complete the preferred muck removal and placement. All the muck removal would occur within Osceola County. It is not believed that the primary consequence of the expenditures of the muck removal and placement or the secondary consequences of affecting the NED account discussed above is going to have a significant RED effect in the study area. The construction expenditures may create some short-term income and employment in the region. Negative effects may include short-term reductions in income to fish camps and other recreation related businesses.

4.17.5. OTHER SOCIAL EFFECTS (OSE)

The preferred restoration plan could have socio-economic effects on the study area that are not identified in the national economic development (NED) account or in the regional economic development (RED) account. The Other Social Effects (OSE) account provides the opportunity to display and integrate into water resources planning information on plan effects from perspectives that are not reflected in the NED and RED accounts. The urban and community impacts are expected to be minimal considering the short construction period and recovery period. The proposed action is not expected to affect the health or safety of the residents.

4.18. FREEZE PROTECTION

4.18.1. EFFECT OF LAKES ON NEARBY ATMOSPHERIC TEMPERATURES

Lakes such as Lake Toho and Lakes Kissimmee, Hatchineha, and Cypress can have an influence on atmospheric temperatures near the lakes. This is due to the high heat storage capacity of water, as compared to that of organic soils and sands. When the atmospheric temperature falls below the water temperature, heat is transferred from the water to the atmosphere. Wind also plays an important role in temperature modification because it pushes the warmed air from the surface of the lake over the surrounding area. The amount of temperature modification decreases with distance from the lake (Ingram, 1983). According to Bill et al. (1977), lakes, being warmer than the air and surrounding land, release sensible and latent heat under typical cold conditions after passage of a front. No substantial thermal effects to the surrounding lands should be expected under low wind conditions.

4.18.2. LAKE APOPKA STUDY

Although the ability of lakes to modify nearby temperatures is intuitively easy to understand, quantification of this effect is difficult due to many uncertainties and complexities. According to Rogers and Rohli (1991), the relationship between air temperature and freeze severity is complicated by several factors, including the age of the citrus trees, current climatic conditions (such as periods of drought), and factors such as irrigation and measures used in combating the freeze. The coldhardiness of the tree and the degree of dormancy at the time of the freeze are also critical factors. In addition, the duration of the freeze and the wind speed are important factors (Miller and Downton, 1993). A study of freeze protection for citrus provided by Lake Apopka was conducted for the Lake Apopka Restoration study (Bartholic and Bill, 1977). In this study it was reported that Lake Apopka had a mean depth of about 5.5 feet. Results of this study have been applied qualitatively to the project Toho area, much as Ingram (1983) did for Lake Griffin. The Lake Apopka freeze protection study concluded that an insignificant reduction in freeze protection would occur if at least one meter (3.3 feet) of water depth was maintained over a large portion of the normal lake area. It was assumed that temperature modification occurred on the south and southeast sides of Lake Apopka or on the downwind side.

4.18.3. MEAN DEPTHS AND SURFACE AREA COVERAGE

Table 4 contains the capacity (volume), surface area, and mean depth of Lake Toho, Lakes Cypress and Hatchineha, and Lake Kissimmee at their high pool water levels. Tables 5 and 6 contain the capacity (volume), surface area, and mean depth of Lake Toho, Lakes Cypress and Hatchineha, and Lake Kissimmee at their proposed drawdown (February 15) water levels in Alternatives 1 and 4w, respectively. Tables 4, 5, and 6 include mean depth information for Lake Tiger which fluctuates with lake Kissimmee. Tables 5 and 6 indicate that all of the lakes' mean depths during the proposed drawdown would be approximately one meter or more. Lake Toho is estimated to have a mean depth of 3.1 feet at the proposed drawdown water level of 49.0 ft NGVD in Alternative 4w. Figures 7, 8, 9, 10, and 10a contain contour maps from which one can estimate areas which would remain covered by water and areas where lake bottom would be exposed at the proposed drawdown water levels in Alternatives 1 and 4w. The contour maps were obtained from the USACE's Fisherman's Guide to the Kissimmee Chain of Lakes. A comparison of Tables 4 through 6 and Figures 7 through 10a reveals that even at the proposed drawdown water levels, there is still a sizable volume of water and surface area coverage in the lakes. The proposed drawdown water levels are expected to provide a level of freeze protection similar to that which has been available under historical conditions.

4.18.4. HISTORIC FREEZES AND ASSOCIATED WATER SURFACE ELEVATIONS

Table 7 shows Lakes Toho, Kissimmee, Hatchineha, and Cypress historic freezes and associated water levels since construction of the C&SF Project. Temperature data was obtained from the National Oceanic and Atmospheric Administration (NOAA).

4.18.5. POTENTIAL BENEFIT OF DRAWDOWN TO FREEZE PROTECTION

Although there is a potential reduction in freeze protection due to the drawdown, there is also a potential long-term impact of the drawdown on freeze protection which is positive. The project may eliminate the buildup of organics and subsequent dense plant growth in Lake Toho adjacent to citrus groves. This would prevent the formation over time of a vegetative buffer that could block the direct flow of air from the warm water to the groves.

4.19. CUMULATIVE IMPACTS

Lowering the lakes would not result in cumulative impacts (other than impacts on the snail kite that are undetermined at this time, as discussed in the following paragraph).

Inlake disposal would result in the loss of wetlands. The cumulative effects of the loss of these wetlands were considered (or will be considered in the case of the permit modification and unissued permits) as part of the DA Regulatory permit process. Refer to sections 1.8, 3.14, 4.5, 4.19, and Appendix A for more details about the permit, the permit modification, and a copy of the permit.

Effects of both action alternatives on the snail kite are being evaluated during formal consultation with USFWS in accordance with the ESA. Formal consultation includes evaluating the cumulative impacts of the project on threatened and endangered species. No action will be taken until coordination has been completed under the ESA.

4.20. LOCAL SHORT-TERM USES AND MAINTENANCE/ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Implementation of any of the alternatives other than the No Action would result in some short-term losses in overall productivity and in temporary inconvenience to on-going activities. Completion of the proposed drawdown plan is expected to result in long-term benefits and some temporary adverse effects during the course of the action. However, over the long run, an increase in beneficial productivity, and preservation and enhancement of a recreational fishery resource would be expected.

4.21. COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

Stable water levels have contributed to the problems associated with degraded aquatic habitat in Lakes Toho, Hatchineha, and Cypress. The USACE has a related study underway, the Comprehensive Analysis of the Upper Kissimmee Chain of Lakes (KCOL), that includes evaluating the effects of implementing revised regulation schedules for seventeen (17) lakes including: Lakes Kissimmee, Hatchineha, and Cypress; Lake Toho; East Lake Toho; Lakes Hart and Mary Jane; Lakes Joel, Myrtle and Preston; Lakes Alligator, Brick, Lizzie, Coon, Center and Trout; and Lake Gentry. The Lake Toho Project is compatible with the KCOL project. In fact, the KCOL project would take a comprehensive approach to eliminating the damaging results that stable water levels have had on fish and wildlife resources on lakes within the KCOL including Lake Toho. This project is not in conflict with any known state or local objectives.

4.22. CONFLICTS AND CONTROVERSY

Areas of conflict and controversy identified at this time include possible adverse effects from temporary restriction of navigation to different areas within and between the different lakes being lowered, and the Kissimmee River during periods of low or no flow; potential loss of revenue to local fish camp operators, marinas, and other fishing-related businesses during the drawdown; the public's concern about the project's potential effect on groundwater levels; use of in-lake disposal islands; aesthetic impacts; and possible impacts on the endangered snail kite.

4.23. PRECEDENT AND PRINCIPLE FOR FUTURE ACTIONS

This would not be the first time an extreme drawdown for habitat enhancement activities has been implemented for Lake Toho. Previous drawdowns of Lake Toho were implemented in 1971, 1979, and 1987. Therefore, no precedent would be set by the action.

4.24. ENVIRONMENTAL COMMITMENTS

Coordination of this Final EIS with the agencies may result in additional requirements when completed. However, as a placeholder in this Final EIS it can be stated that contractors would be required to commit to avoiding, minimizing or mitigating for adverse effects during construction activities by including these commitments in the contract specifications: designating that turbidity controls would be utilized to insure that State water quality standards are met during all construction activities, ensuring that erosion control provisions would be undertaken to stabilize all disposal islands, and insuring that all terms and conditions required by USFWS as part of the Endangered Species Act coordination would be included. The future contract specifications would prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and would require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan would be required.

Coordination with USFWS has been initiated and a Biological Opinion will be rendered. Implementation of any alternative would take into account their recommendations to ensure that threatened or endangered species (the snail kite in this case) are not adversely impacted by the project.

4.25. COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

4.25.1. NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

Environmental information on the project has been compiled and this Final Environmental Impact Statement has been prepared. The project is in compliance with the National Environmental Policy Act at this stage of planning.

4.25.2. ENDANGERED SPECIES ACT OF 1973

Formal consultation was initiated with USFWS on Feb 22, 2001, and is still in progress. This project is being coordinated under the Endangered Species Act and is therefore, in partial compliance with the Act at this time. However, consultation will be completed before any action is taken to insure full compliance with this Act.

4.25.3. FISH AND WILDLIFE COORDINATION ACT OF 1958

This project has been coordinated with the U.S. Fish and Wildlife Service (USFWS) through the Corps' Regulatory and NEPA processes. Comments under the Coordination Act were provided by USFWS by letter dated October 5, 2001 that also provided comments under the ESA. This project is in full compliance with the Act.

4.25.4. NATIONAL HISTORIC PRESERVATION ACT OF 1966 (INTER ALIA)

Consultation with the Florida State Historic Preservation Officer (SHPO), has been conducted in accordance with the National Historic Preservation Act, as amended; the Archeological and Historic Preservation Act, as amended and Executive Order 11593. SHPO consultation was initiated October 4, 2001. In a letter dated October 26, the SHPO stipulated conditions for FWC to meet in conducting the environmental enhancement work and concurred with the Corps determination of no effect to properties listed or eligible for listing on the National Register of Historic Places.

4.25.5. CLEAN WATER ACT OF 1972

The project is in compliance with this Act. The FWC has applied for and received a Department of the Army permit to perform work, place structures, and place fill in waters of the U.S. A Public Notice was issued, public comments solicited, and a Section 404(b) evaluation was completed as part of the Regulatory process. A copy of the permit is included in Appendix A.

4.25.6. CLEAN AIR ACT OF 1972

No air quality permits would be required for this project. This project is being coordinated with U.S. Environmental Protection Agency and is in compliance with Section 309 of the Act. This Final EIS will be forwarded to EPA for their review.

4.25.7. COASTAL ZONE MANAGEMENT ACT OF 1972

This project is in compliance at this time. Comments from the Florida State Clearinghouse indicated that the project is consistent with the Florida Coastal Management Program. A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix D.

4.25.8. FARMLAND PROTECTION POLICY ACT OF 1981

No prime or unique farmland would be impacted by implementation of this project. This act is not applicable.

4.25.9. WILD AND SCENIC RIVER ACT OF 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.25.10. MARINE MAMMAL PROTECTION ACT OF 1972

No marine mammals would be affected by this project. This act is not applicable.

4.25.11. ESTUARY PROTECTION ACT OF 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.25.12. FEDERAL WATER PROJECT RECREATION ACT

The project is in full compliance at this stage. The effects of the proposed action on outdoor recreation have been considered and are presented in the Final EIS.

4.25.13. FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

Marine waters or resources under the jurisdiction of National Marine Fisheries Service are not impacted by this project. Therefore, this act does not apply.

4.25.14. SUBMERGED LANDS ACT OF 1953

The project was coordinated with the State during the permit process. Impacts on submerged lands were evaluated during that time and will be again evaluated during the processing of the permit modification requested by FWC. Refer to paragraph 1.8.

4.25.15. COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. These acts are not applicable.

4.25.16. RIVERS AND HARBORS ACT OF 1899

FWC has applied for and received a Department of the Army permit to place fill in navigable waters of the U.S. See Appendix A for permit. The proposed action has been subject to the public notice, public hearing, and other evaluations normally conducted for activities subject to this act.

4.25.17. E.O. 13186, MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.25.18. E.O. 11990, PROTECTION OF WETLANDS

The drawdown would not directly result in the loss of wetlands. However, for the demucking activities, if upland disposal sites are not obtained, which appears unlikely for all the material, then the project would result in the loss of wetlands as a result of in-lake disposal islands. However, in that case there would be no practicable alternative. The work has been (for the permit already issued) determined to be in the public interest through the DA Regulatory process (refer to section 1.8). The public interest will be considered in the pending permits.

4.25.19. E.O. 11988, FLOOD PLAIN MANAGEMENT

This project does not involve construction of any structures within the floodplain nor restrict flow through any floodplain. Therefore this project is in compliance with this executive order.

4.25.20. E.O. 12898, ENVIRONMENTAL JUSTICE

The proposed action would not result in any disproportionate effects toward any minority or low income population. The activity does not exclude persons from participation in, deny persons the benefit of, or subject persons to discrimination because of their race, color, or national origin. The action would not impact "subsistence consumption of fish and wildlife."

4.25.21. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

This act applies to marine resources under the jurisdiction of National Marine Fisheries Service (NMFS). Since this work does involve marine waters, or any species under the jurisdiction of NMFS, this act does not apply.

4.25.22. E.O. 13112, INVASIVE SPECIES

One of the purposes of the project is to facilitate treatment for hydrilla during low lake stages, as described in paragraph 4.3. Paragraph 4.3 further describes the interagency invasive plant management program that the FDEP, Corps, SFWMD, FWC, and other agencies participate in. This project would support the management of invasive species, particularly hydrilla.